SCIENTIFIC AMERICAN

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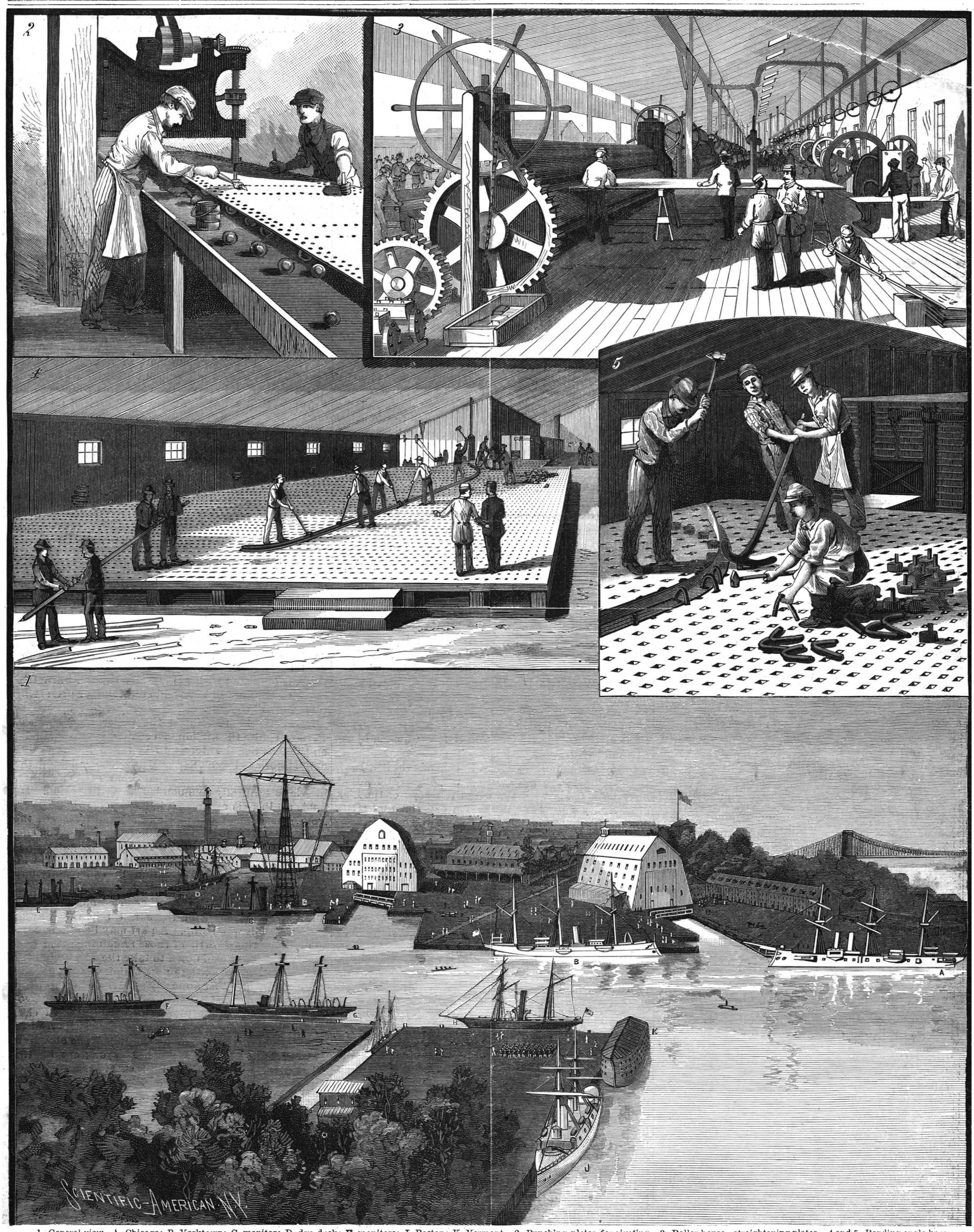

1. General view—A, Chicago; B, Yorktown; C, monitor; D, dry dock; E, monitors; J, Boston; K, Vermont. 2. Punching plates for riveting. 3. Roller house—straightening plates. 4 and 5. Bending angle bars on iron beds made for the purpose.

THE BROOKLYN NAVY YARD AND SHOPS.—[See page 180.]

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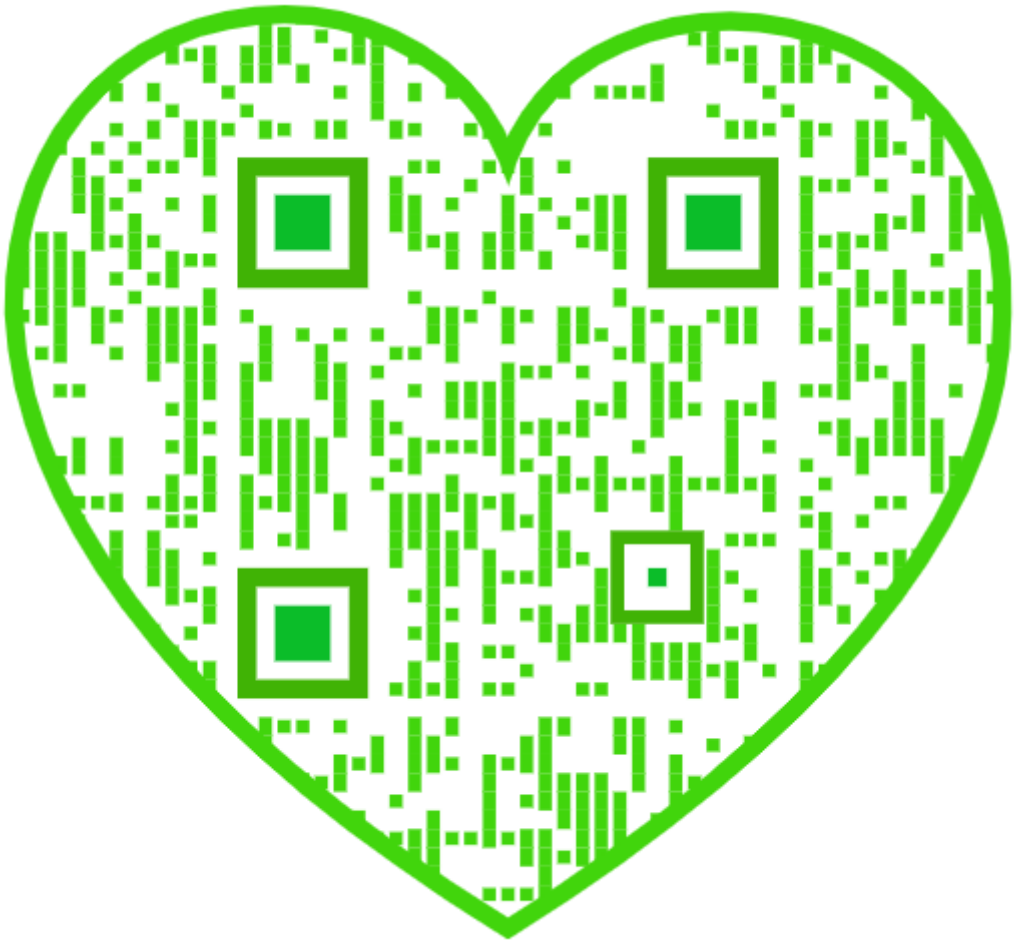

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NEW YORK, SATURDAY, SEPTEMBER 21, 1889.

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THE RECENT MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The success of any public meeting depends largely on the facilities furnished for its sessions. The University of Toronto was originally endowed with so vast a property that its managers were under the impression that the time could never come when it would all be needed for educational purposes. Accordingly they surrendered to the city ground now valued at several million dollars. But enough remained to enable them to erect some of the noblest edifices of the sort on this continent. The buildings are of granite, and are erected with admirable architectural skill.

The main frontage is 300 feet long, facing an ample grassy lawn, and has an imposing Norman tower near its center. The east side is 260 feet long, with a subsidiary tower. The west side has dormitories, residences, a refectory, etc. The interior quadrangle thus inclosed opens on the north toward the park. The whole structure was generously thrown open to the A. A. A. S. Around the vestibule were temporary offices for postal, telegraph, telephone, and to some extent railroad facilities. Adjoining rooms were for correspondence, committee rooms, the display of specimens, apparatus, scientific books and wares. The daily general sessions were held in Convocation Hall at 10 A. M. But although some 600 members and fellows, including 199 new members, were registered, it was seldom that more than half that number were in attendance at the general sessions, for the reason that it has come to be understood that little is done there except in the line of dry, routine business. The members certainly ought to attend to these necessary details. But as a matter of fact, many of them prefer to look over their morning mail, or to inspect the public libraries and cabinet, or even to chat with their friends in the corridors. It seems to be becoming more and more obviously true that the great A. A. A. S. is really but a bundle of minor scientific societies bearing the name of "sections."

Each new member, on joining, is expected to identify himself with one or more of these sections; and usually his main interest centers there so completely that he never even enters the rooms appropriated to the other departments of scientific investigation. This is unfortunate; for it would prove beneficial for the physicist to dip into chemistry, and for the astronomer to take a taste of geology, and the statistician to refresh himself with a little botany. But, on the other hand, when it is remembered that there were offered at the Toronto meeting no less than 228 different papers, besides the more extended lectures and addresses, it is evident that a hearing for them can be had in no other way than by the plan now adopted. The method resorted to at the Boston meeting might wisely be employed at all meetings, viz., of having a bulletin in each section announcing what was in progress in all the other sections, so that members could have some option as to what particular papers they would choose to hear, the bulletins being constantly corrected by telephone.

In trying to describe, however briefly, the work done in the sections, we meet the difficulty of doing justice to more than two hundred carefully prepared communications, in some cases the result of several years' research, and often accompanied by maps, diagrams, and pictures, or by long columns of figures and symbols. We can merely indicate a few whose subjects particularly drew attention.

In the astronomical section, that heads the list, Prof. E. S. Holden gave a report on the observations that have been made with the great telescope of the Lick observatory since June, 1888. An experimental series of moon photographs was made, some difficult points in lunar topography were settled, the eclipse of July, 1888, was carefully observed. Neptune had been so diligently watched as to make it certain that the planet has no new satellites. Venus and Mercury were also observed, as well as several comets; notably the comet Brooks and its family of cometary masses. Prof. Burnham also read a paper concerning the double star discoveries made at the Lick observatory. Communications were made regarding the new Dearborn observatory, and the work expected from it; on the automatic eclipsograph; the Hastings achromatic objective; on the solar corona; and on the solar parallax and its related constants.

An important memorial for "A Universal Day" was offered by Prof. Charles Carpmael, of Toronto, to the effect that the A. A. A. S. should address the governments of the United States and Canada, each State, Territory, and Province, and every nation in diplomatic relation with them, relative to the establishment of a day of 24 hours each, numbered from 1 to 24 consecutively, regulated by standard hour meridians, in conformity with the proposal already made by the International Convention held at Washington, in 1884. The memorial was referred to the Council of the Association, after being remarked upon by those present.

In section B, that of physics, Prof. H. C. Bolton, who has just returned from the peninsula of Sinai, exhibited a map of the region and lantern views of its scenery, much of which was almost Alpine in its grandeur, as well as fraught with the deepest historic interest. His special scientific purpose was to investigate the musical sands of Jebel Nagous, where a huge sand bank is constantly shifting its position, with sonorous accompaniments. He also explored another locality, not previously noticed, where the sonorous sand exists in cliffs a quarter of a mile long. He said that similar sands had been observed along the southern coast of England and the Atlantic coast of the United States. Specimens were exhibited and a degree of interest awakened that led Dr. Bolton to repeat his address, in a popular form, in the pavilion, where he was heard by several thousand people.

Prof. W. LeConte Stevens criticised the rule commonly used for estimating magnification in the microscope, and suggested a better way. Prof. Gray discussed the electro-dynamic and the magnetic methods of measuring electricity, the former being found to be within 1-20 per cent of the absolute, and the latter within 1-100 per cent of the absolute. Prof. Ryan explained the quadratic electrometer, with its cylindrical needle and quadrants, magnetized steel mirror, and surrounding coil of wire. Prof. Mendenhall reviewed the evidence for the existence of globular lightning, as presented by Arago, and others earlier and later, adducing such a mass of evidence that, although to some degree conflicting, the reality of the phenomenon must be admitted. Judging from the discussion that ensued, it seemed to be the prevailing impression that these fire balls result from some other cause than electricity. Prof. Barker spoke briefly of recent progress in storage batteries; and Mr. Rosebrugh described some experiments in duplex telephony.

The proceedings of the chemical section were enlivened by a timely discussion on the matter of spelling and pronouncing terms, and also by a debate as to the propriety of abolishing the old system of apothecaries' weights and measures and introducing the metric system in medicine and pharmacy. The latter resulted in the adoption of a corresponding resolution, together with the appointment of a member to cooperate with the American committee on a system of international standards between this country and Europe. Still another matter that excited much interest was the advisability of forming a national chemical society. A resolution looking in that direction was lost by a single vote, the objection being that it might impair the interest now taken in the A. A. A. S. A better fate awaited the report in favor of securing a due place for chemistry in all our public schools. It was unanimously adopted, on the ground that this branch of science is too important to be omitted from any curriculum, although the various methods of teaching it may be wisely adapted to the age of the pupils.

Prof. Chanute spoke before section D, on the "Preservation of Timber." The importance of this topic appears when we consider that the annual loss to the United States for railroad ties alone amounts to $25,000,000, besides the immense losses in bridges, telegraph poles, fences, etc. The growing scarcity of wood suggests means of preventing its decay. Among the most successful are: Kyanizing with corrosive sublimate, copperizing with sulphate of copper, burnettizing with chloride of zinc, and creosoting or preserving by the use of coal tar.

Here may be mentioned the paper read by Prof. Fernow before the section of economics and statistics on the "National Interest to be taken in preserving our Material Resources." Being the chief of the forestry division of our Department of Agriculture, his views naturally commanded great attention. He holds up Prussia as a model in its resolve to hand down from generation to generation the great forests of the country, merely using what might be called the current revenue of them. The American population is sparse as compared with the forests, and a man who fells one grove has no doubt that he can readily buy another. Forestry should really be the use of the soil for a timber crop, just as another piece might be used for a wheat crop. And there is a scientific way of gathering this wood crop. A part may be taken so as to promote the growth of those remaining; and new plants may be seeded down to take the place of those removed. But as matters now stand, our people use twice as much timber annually as is replaced.

Section E divided its time with the American Geological Society, whose proceedings are reported elsewhere in these columns. Among the papers read in this section, however, may be mentioned one on "New Fossil Plants," by Sir William Dawson; one on the "Lake Ridges of Ohio," by Prof. G. F. Wright; an account of recent discoveries in Mammoth Cave, by H. C. Hovey; and one on the "Strain on the Crust of the Earth," by E. W. Claypole.

The anthropological section always has plenty to do. The members heard Professor Putnam tell about the famous Serpent Mound in Adams County, Ohio, which, with 75 adjoining acres, was bought to be kept as a public park under the care of the Peabody Museum. The mound is 1,400 feet long and lies on a bluff overlooking Brush Creek. Its tail has a triple coil, its body three convolutions, and in its open jaws there is a small oval mound. Other papers were about "Aboriginal Fire Making;" "The Evolution of Ornament;"

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"Shinto Religion of the Japanese;" "The Iroquois White Dog Feast;" "Missions among the Indians of California;" "The Ancient Pit Dwellers of Yezo;" "The Contents of Children's Minds," etc.

The section of biology was likewise crowded with topics of more or less interest and importance. Sir C. V. Riley, whose indefatigable services have lately won for him the honor of knighthood, couched his lance again for an attack on all the foes of wholesome vegetation, explaining the intentional importation of friendly parasites, thus "setting a thief to catch a thief." Mr. F. L. Scribner exhibited and classified 25 species of grasses found at the summit of Roan Mt. Professor T. J. Burrill, of Champaign, Ill., described a newly discovered bacterial disease of Indian corn. A. J. Cook explained the alimentary apparatus of the honey bee. Professor N. L. Britton read a paper on the flora of New Jersey.

Having thus hastily skimmed over the long array of scientific papers, it remains to say a word about the excursions. About 250 went as the invited guests of the local committee, to visit the wonders of Niagara Falls, going and returning on Saturday. Some 125 availed themselves of a longer trip to the charming Muskoka Lakes, lying north of the Georgian Bay. Steamers and yachts and row boats were placed at their disposal, on which they wound in and out amid the 365 islands that are said to dot the chain of lakes, although no one seemed sufficiently curious to verify the count. At the close of the sessions, a party of geologists, about 30 in all, took an excursion amid the Huronian rocks about Sudbury, and other localities north of Lake Huron, also exploring the copper mines of that region.

The next place of annual meeting will be the city of Indianapolis, and the date is fixed a week earlier than this year, viz., August 19, 1890. Prof. G. L. Goodale, of Harvard University, was elected president, Prof. F. W. Putnam permanent secretary, Prof. H. C. Bolton, of New York, general secretary, with eight vice-presidents and as many secretaries for the sections. The closing courtesies of the occasion were tendered, on both sides, with more than usual heartiness. The association evidently won many friends in Toronto, and its members certainly carried away most agreeable memories of what its inhabitants proudly style the Queen City of the Northwest.

EIKONOGEN—A NEW UNIVERSAL DEVELOPER FOR PHOTOGRAPHIC DRY PLATES AND BROMIDE PAPER.

Advances in photography are now so rapid that it is somewhat confusing to the professional or amateur photographer as to when and where the improvements will stop—if they ever do. Simply the subject of developers for dry plates would compose a volume if all the formulas, with their variations, were published, including as it would the experience and whims of hundreds of photographers. Scientists in chemistry have been experimenting upon the remarkable reducing power on the silver salts observed in the derivatives of aniline, and have endeavored to make them of practical use in photography.

Such a derivative was discovered early in this year by Dr. Andresen, of Berlin, Germany, and is named "eikonogen." It is manufactured there by very extensive aniline dye works, and promises to supplant all other developing agents yet proposed.

It is a substitute for pyrogallol, hydroquinone, oxalate of potash, and sulphate of iron, and, in fact, of all chemicals that reduce the silver salts. As it can be so easily made, it becomes at once the cheapest reducing chemical now on the market, and we have no doubt, as the demand increases, the price will be still lower. It is packed in small tin cans similar to those holding aniline dyes, having a hinged spout at one corner.

It will keep indefinitely in a dry powder in any climate, provided it is not injured by the fumes of ammonia, with which it must not come in contact. It is in the form of a greenish-white powder, which, when dissolved in water, turns to a dark green color, but is perfectly clear.

The advantages claimed for it, and which we have found to be substantially true by experiment, are that it produces a bluish-black colored image, depositing in the film a very delicate precipitate, which, in consequence, brings out the finest details to a degree that is surprising. The structure of the picture film is, therefore, much more compact and finer grained than it is possible to obtain with the pyro or ferrous oxalate developer. The developer operates regardless of the temperature. Hence it is adapted for use in hot or cold climates. It is non-poisonous, perfectly harmless, does not stain the fingers, does not discolor or deteriorate when exposed to the air in a tray or graduate, always keeps clear, will keep mixed in a well-stoppered bottle ready for use for over a month, and acts so quickly and powerfully that the ordinary exposures given for pyro development may, it is said, be reduced one-half. But its pre-eminent quality, in addition to its great reducing power, is that it does not stain the film in the least, even after repeated use, and hence a given quantity of solution may be used over and over again, until its developing power ceases.

The stainless nature of the developer adapts it admirably for the production of line work negatives on dry plates, for the development of lantern slides, and for positive prints on gelatino-bromide paper or porcelain. So satisfactory is its working on paper that we have substituted it for the ferrous oxalate developer. Its particular merit is that every copy on paper is beautifully clear in the high lights, which is a point of great importance in making bromide enlargements.

For shortly exposed plates and bromide paper the following formula for a one-solution developer works well:

Sulphite sodium C. P.	2 oz.
Carbonate of potash	1 "
Distilled, melted ice, or rain water	30 "
Eikonogen	1 "

Dissolve in the order named. Eikonogen is perhaps ten times less soluble than pyro. We tried to dissolve the ounce in 10 and 20 ounces of distilled water, but without success. In using this developer it is advised that from six to eight drops of the following accelerating solution be added:

Hyposulphite of soda	60 gr.
Bromide of sodium	360 "
Water	8 oz.

We simply added three or four grains of bromide of potassium to five ounces of the developer and obtained good results.

It is not necessary to mix the carbonate of potash to form one solution. It may be kept separate and dissolved in concentrated form in the proportion of 160 grains to the ounce of water. Taking five ounces of the sulphite and eikonogen solution and adding thereto from ¼ to ½ a drachm of the potash solution, as a developer will bring out an ordinarily well-exposed plate as rapidly as if a strong pyro and potash solution were employed. After the image is well out and there are some details in the shadows that do not appear, it is only necessary to add a drachm of the potash solution to the developer to easily bring them out. There is no fogging of the film whatever by the developer. Hence though the image may appear suddenly and be well developed within a minute after the developer is applied, one need not fear to leave it on long enough to acquire sufficient density. If the developer operates too fast, it may be improved by diluting with water and adding a few grains of bromide of potassium. Or the developer may be poured off and a weak bromide of potassium solution be poured on. A developer for lantern slides need not be as strong in eikonogen as for negatives. We recommend the following proportions:

Sulphite sodium C. P.	10 gr.
Carbonate of potash	2 "
Eikonogen	5 "
Water (distilled or rain water)	1 oz.

The above may be used as one solution, and will develop a number of lantern slides. As soon as it begins to work slow, 2 or 3 grains of carbonate of potash added will accelerate it. The high lights will be absolutely clear, while the black portions will not be too dense for the lantern. The tone is bluish black.

Eikonogen and Soda Developer.

A.

Sodium sulphite (crystals C. P.)	4 oz.
Distilled water	60 "
Eikonogen	2 "

B.

Sodium carbonate (crystals)	3 oz.
Distilled water	20 "

Dissolve in order named. A developer is made by adding to 3 oz. of A, 1 oz. of B.

Single Solution, Eikonogen and Soda Developer.

Sodium sulphite (crystals C. P.)	4 oz.
Sodium carbonate	3 "
Distilled water	80 "
Eikonogen	1 "

Dissolve in the order named. Add a few drops of the hypo solution during development. All of the formulas are based on 437½ grains to the ounce.

The usual alum and fixing baths may be employed.

We notice that the developer permeates the film more evenly and rapidly than with pyro, and acts with an energy which is astonishing. For under-exposed or instantaneously exposed plates it is especially adapted, and will make the production of such pictures a pleasure.

We have developed in seven ounces of solution twelve 10 by 12 plates in succession, without replenishing it. After four plates have been developed, the solution should be filtered to eliminate the floating particles of gelatine that become detached during development. The color becomes yellow when it is exhausted. It is probably unnecessary to rock the tray. We are glad to know that eikonogen is to be supplied to the trade here in large quantities. As a universal developer for dry plates, it stands at the head.

Traction Increaser.

An electric traction increaser for increasing the tractive power of locomotive engines, invented by Elias E. Ries, of Baltimore, has just been tested with satisfactory results, so says *Engineering News*, on the Philadelphia & Reading Railroad. The trials were made on the Frackville grade, 185 ft. per mile. The apparatus consists of a small dynamo and engine mounted upon the locomotive and furnishing an electric current, which is passed from the forward to the rear driving wheels, through that portion of the track rails lying between them, causing an increased friction between the wheels and the rails, which is claimed to be far superior to that obtained by sanding the tracks. With the dynamo running and a train of 45 cars attached to the locomotive, the ascent was made in 28 minutes, while without the current a trip over the same ground, with the same train behind, required 55 minutes. The current used is low tension, and the increased traction obtained is under complete control by the engineer.

The Great Storm.

During the week ending September 14 the Atlantic coast, for a range extending from Maine to Virginia, was visited by the worst northeast gale known for many years. The storm in this city began on Tuesday, September 10, and for three days raged with unabated severity, after which it gradually became reduced in strength. It was characterized at first by very high winds, accompanied by some rain, and toward the end there was an exceedingly heavy precipitation of moisture. The barometer during the three days changed very little. The registry on the SCIENTIFIC AMERICAN barometer showed nearly a straight line, beginning to take an upward direction on Friday.

Along the coast very high tides, accompanied by high seas, prevailed. At the summer resorts on the New Jersey and Long Island shores much damage was done. At Coney Island the temporary structures on the beach were swept away or seriously damaged. The lawns of the hotels were covered with sand swept in by the waves; and the Brighton Beach race course was inundated, so that boats were rowed over the site of the track and field. The Brighton Beach hotel, moved back last spring as described at the time in this paper,* was threatened, but although the waves washed up nearly to the sills, the building itself was uninjured. One thing was made clear, that, if the sand strip called Coney Island is to be preserved, a more adequate protection than any hitherto afforded it is essential. The breakwaters at Brighton and Manhattan Beach proved of no value, and were all swept away.

The story from the New Jersey coast was a similar one. From Sandy Hook south to the Delaware, immense damage was done. The sea broke through the Sandy Hook peninsula and opened the old inlet that formerly existed there, but which has been closed for many years. Later a new inlet was temporarily opened, so that Sandy Hook at one time was two islands. Seabright, Long Branch, and the resorts below them were injured to the extent of many thousand dollars. Further south, at Atlantic City, the state of affairs was still worse. On Monday, the last train for three days left the city. The water then advanced and, sweeping around the city, flooded the low ground back of it, cutting it off from the mainland and converting it into an island. Some twenty thousand people were thus cut off, and much fear was entertained of privation, if not of famine. Whole rows of houses were inundated, and no accurate estimate of the damage can be given. On the second day of the storm, five men undertook to leave the place. By creeping along the railroad tracks and swimming the deep cuts they managed to reach the mainland. The trip of five miles to Pleasantville occupied four hours. Later a number of trips of this character were made, and on Thursday, at ten o'clock in the morning, the first train, since the inundation, left Philadelphia for Atlantic City. Since then, regular communication has been maintained, and trains have been crowded with those leaving.

Shipping was greatly delayed. The coasting vessels sought harbors wherever they could find them. The Delaware Breakwater anchorage was crowded far beyond its capacity. The waves broke over the structure and carried away the fog bell, wrecked the telegraph station and several piers. At last the vessels began to come ashore, and one after another they struck the beach until nearly thirty were stranded. The crews of the vessels that reached the beach were all saved. Others foundered further out, and many sailors were drowned, the loss of life in that vicinity being in the neighborhood of fifty souls.

The outgoing steamers carried a number of pilots to sea, it being impossible for them to leave the vessels they were engaged on because of the storm. The United States cruiser Atlanta left the New York navy yard on Monday, bound to Newport. For three days nothing was heard of her, and much anxiety for her fate was entertained. She did not reach her port until Thursday morning, although in ordinary weather the distance should have been made in twelve hours.

In New York the high tide occasioned much discomfort to occupants of buildings near the water. Their cellars were flooded at each high tide. Up Long Island Sound many vessels were delayed, and any quantity of yachts were carried away from their moorings and wrecked and stranded.

On the whole, it is safe to say that the storm has been one of unprecedented effect upon this coast. The damage done by it will be far greater than that caused by any previous gale.

*SCIENTIFIC AMERICAN, April 14, 1888.

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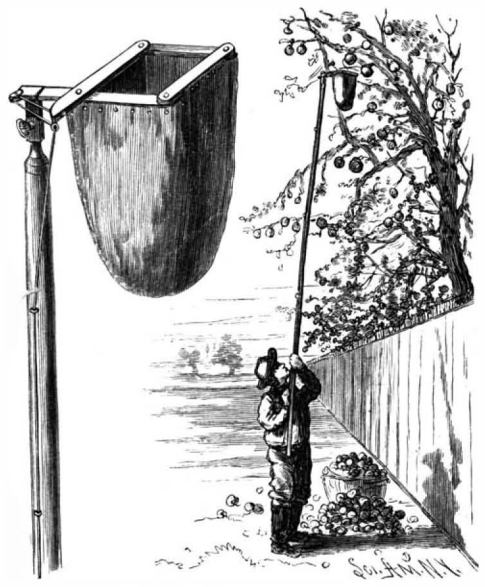
AN IMPROVED FRUIT PICKER.

A device to facilitate the gathering of fruit without bruising the fruit or injuring the tree is illustrated herewith, and has been patented by Mr. Stephen Brazee, of Preston Hollow, N. Y. The device consists of a bag attached to a lazy tongs frame provided with

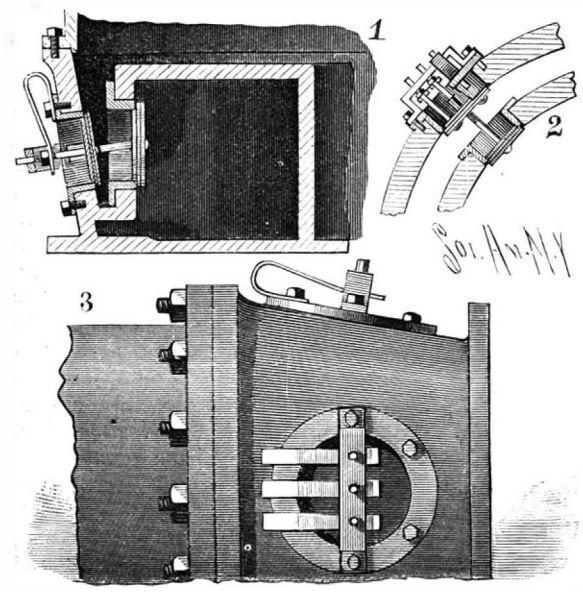


BRAZEE'S FRUIT PICKER.

a handle of suitable length, and connections between the handle and frame whereby the tongs may be readily operated by means of a cord passed through eyes or guides down the handle. Two members of the lazy tongs extend beyond the pivotal point to which the inner edge of the bag is attached, and on the lower side of one of these members is a post adapted to be adjustably secured to a stud on the upper end of the handle. To normally hold the frame open, and to open it automatically when it has been contracted, a spiral spring is coiled in recesses around the inner pivotal pin, one end of the spring being secured to each of the two inner members of the frame. For closing or contracting the frame, a cord attached near the inner end of one member of the lazy tongs is passed around a pulley on the outer end of the other member, and thence back through an eye on the first member and down the handle, so that by drawing upon the cord the frame is contracted around the fruit and can be conveniently brought in contact with the stem.

AN IMPROVED VALVE HEAD FOR BLOWING ENGINES.

A valve head designed to receive and discharge a great quantity of air at each stroke, and whose construction is such as to permit of an easy replacing of a worn-out valve without taking off the usual hand-hole plate or disturbing the other parts of the engine, is shown in the accompanying illustration, and has been patented by Mr. Calvin L. Moore, of Lebanon, Pa. Fig. 1 is a sectional side elevation, and Fig. 2 a sectional plan view of the improvement, Fig. 3 showing its application to the end of a cylinder. The valve head has a casing, with exterior annular rim secured by one end to the cylinder, there being in the rim a desirable number of inlet valves, directly behind which, in the inside of the casing, are discharge valves, located in a rim of the annular discharge box, mounted on the inside of the casing and connected in the usual manner with the discharge pipe leading from the engine to the furnace or other place. Each valve in the exterior annular rim is provided with a readily removable valve seat, on the inside of which is held a valve adapted to open inward, and provided with rods extending outward, a spring secured to the outside flange of the valve seat exerting its tension on each of the rods to normally hold the valve on its seat, but permitting it to open inward. Each discharge valve in the discharge box on the inside of the casing has a valve seat on the inside of which is an inwardly opening valve secured on a pin extending outward, and connected with a spring which holds the valve on its seat, and at the same time permits its inward opening. The arrangement is such that when the piston in the cylinder moves backward the outer valves open inward to admit air, but when the piston moves forward these valves are held on their seats by the springs and by the pressure of the air inside of the cylinder, while the valves in the discharge box are opened inward by the force of the air in front of the piston, and the air from the cylinder passes through the inner valve seat in the usual manner to the desired point.



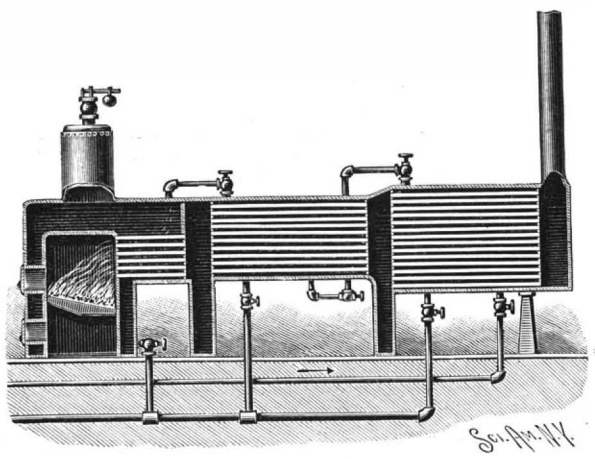
MOORE'S VALVE HEAD FOR BLOWING ENGINES.

The Eiffel Tower.

The receipts of the Eiffel tower continue to increase at a great rate. Up to July 16 the total amount received from visitors ascending the tower was $380,000, and during the week ending July 16 the amount received was $67,000. At this rate the structure will be more than paid for before the close of the exhibition. Besides the money paid for ascents, the rental charged to various concessionnaires amounts to a large sum. A new attraction has been recently added. On the second platform a letter box has been installed, and post cards, provided with a special Eiffel tower postage stamp, are on sale. A vast number of people take pleasure in writing from this height and in knowing that their letters will be collected from the tower box.

AN IMPROVED STEAM BOILER.

The accompanying illustration represents a boiler designed to facilitate the more perfect combustion of all the gases generated, and to effect this it is constructed in sections, one in advance of the other, the flue area increasing as the sections recede from the firebox, and the spaces between the sections forming different combustion chambers. The invention has been patented by Mr. Charles J. Davidson, of 409 Lafayette St., Sioux City, Iowa. Communication between the first and second boiler sections is established by upper and lower pipes, the latter pipes leading to a blow-off pipe which is in communication with the third boiler section. A pipe leads from the upper portion of the



DAVIDSON'S BOILER.

third boiler section to the lower portion of the second boiler section, and stop cocks or valves are arranged in all the pipes. Hollow pedestals beneath the second and third combustion chambers serve as ash receptacles, and the feed water is supplied to the last boiler section, as indicated by the arrow.

New Torpedo Boats.

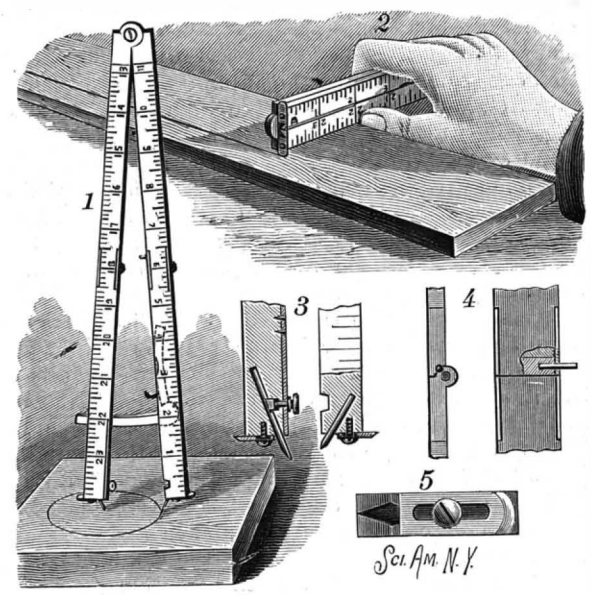
Messrs. Yarrow & Co. have delivered to the authorities at Portsmouth two of the first-class torpedo boats, of which they have several under construction for the British government. These boats have many features of novelty, being of a much improved type when compared with the first-class torpedo boats now in the British navy. They are 130 feet in length, with a beam of 13 feet 6 inches, and on trial obtained a speed of over 22½ knots during a continuous run of three hours, having a weight of 20 tons on board. As regards maneuvering powers, these boats have exceptional capabilities, it being found that at full speed they can turn within a circle the diameter of which is twice the length of the boat.

A Singular Railroad Fire.

A dispatch from Pittsburg, September 4, says: The limited train from the East was thirty-five minutes late last night in arriving, through one of the most unexpected as well as surprising accidents which has happened since the vestibule train has been started. Between Philadelphia and Harrisburg the roofs of the two forward coaches caught fire through friction, which wore off the rubber casing and got the steel plates red hot. The fire was easily put out at Harrisburg, but the fact that the fire was so easily started has set the railroad people thinking of a new way to obviate such accidents. The train went through to Chicago without changing cars, but a meeting will be held within a few days to devise some means of avoiding this new danger to vestibule trains.

A COMBINED CARPENTER'S RULE, CALIPERS, ETC.

The accompanying illustration represents a combination drawing and measuring instrument, which is simple and durable in construction, and comprises a rule, a compass, a marker, and calipers, being especially designed for the use of carpenters and other artisans.



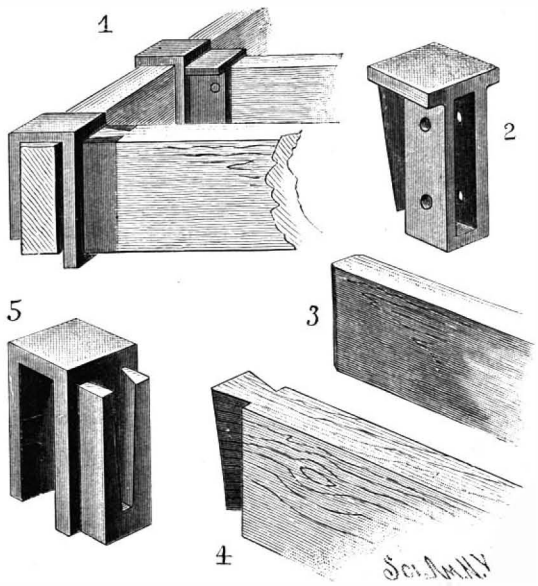
DELMAGE'S COMBINED RULE, CALIPERS, ETC.

It has been patented by Mr. William A. Delmage, of No. 11 Bridge Street, Lowell, Mass. Fig. 1 represents the instrument adapted for use as a compass, Fig. 3 showing the outer ends of the compass points, one of them provided with a pencil. On the main members are hinged end members, evenly dividing the two parts of the rule, the hinges being adapted to be locked by a removable pin, as shown in Fig. 4. The outer ends of the end members are each provided with a metal ferrule, from the end of which a knife or marker extends outward from one side of the ferrule, by means of which the instrument is adapted to mark boards or other lumber, as shown in Fig. 2. Instead of forming the markers directly on the ferrule, a knife or marker may be fastened by a set screw to the ends of the members, the screw passing through a slot to permit of moving the marker inward or outward, as shown in Fig. 5. On one of the end members is pivoted an arm extending at its free end through a slot in the opposite end member, this arm serving to prevent sidewise motion of the two members when the instrument is used as a compass. This arm is held in place by a spring, and when disconnected folds into a recess in one of the members.

AN IMPROVED LOCK JOINT FOR BEAMS.

A lock joint support for connecting the ends of beams with transverse beams, to obviate the cutting and mortising of the transverse beams, and thereby weakening them, is illustrated herewith, and has been patented by Mr. Robert Wray, of New York City. The support is formed in two parts, a hook portion to engage and rest on a beam, and having on one face a vertical projection with a dovetail socket open at the top, as shown in Fig. 5, and a socket portion to receive the end of a beam, as shown in Fig. 2. The socket portion has a dovetail projection to engage the dovetail socket in the hook portion, and a flanged top, the beam being secured in this socket portion by means of bolts, without any cutting or mortising. The hook portion may be used without the socket portion, the beam being then formed with a dovetailed end, as shown in Fig. 4, to engage the socket of the hook portion. Fig. 1 shows the use of this lock joint in both ways.

For further information relative to this invention address Messrs. Little & Hamilton, No. 386 West 125th Street, New York City.



WRAY'S LOCK JOINT FOR BEAMS.

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AN IMPROVED PEN HOLDER.

The accompanying illustration represents a pen holder having a rigid handle and flexible pen receiver, also providing means whereby the degree of flexibility may be regulated at will. It has been patented by Mr. James P. Egan, of No. 2420 Tiebout Avenue, Fordham, N. Y. Fig. 1 shows the construction when a tubular handle is employed, Fig. 2 being a sectional view, and Fig. 4 shows the construction when a solid handle is used, Fig. 3 being a sectional view. Each form of handle has an elastic pen receiver, that used in Figs. 1 and 2 being a solid piece of elastic rubber or its equivalent, with a shank corresponding with the bore of the handle, and a head in which is a semicircular recess to receive the pen. The head is preferably provided with a metal or hard rubber outer plate, with a cut corresponding with that in the elastic rubber receiver, the plate holding the edges of the receiver from fraying. When the receiver is to be attached to a solid handle, as shown in Figs. 3 and 4, one end of the handle is reduced in diameter to receive a metal receiver, and the shank is made longer and tubular at the end to slide over this reduced portion of the handle, while a sleeve is held to slide upon the exterior of the shank between the inner extremity and the head. This sleeve regulates the elasticity or pliability of the solid portion of the receiver, according as it is moved forward or backward.

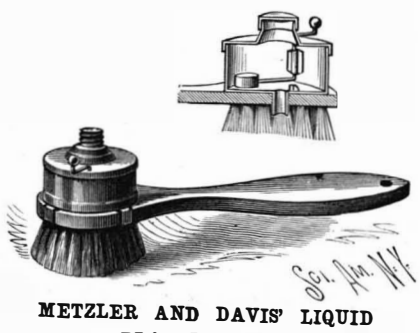
EGAN'S PEN HOLDER.

Life in New York—the Electric Trench Nuisance.

Residents along Sixth Avenue say the ventilation of the trenches creates a regular nuisance on the avenue wherever it is done. Policemen on post declare that the escape of noxious gases at such time is "almost enough to knock a man down." It lasts quite a length of time, and fills the air with a vile odor. The ventilating is done, as a rule, after 11 o'clock at night by a group of men with lanterns, who travel up and down the avenue, opening the manholes one after another and allowing the gas to escape. It gathers quickly and in big volumes in the trenches, and requires constant attention to prevent explosions. The methods of ventilating are still very primitive and apparently imperfect. The men carry the lanterns to use as danger signals to warn drivers that the manholes are open. In the daytime blowers are used at stated intervals to blow the gases from the trenches into the manholes. Disinfectants are used, too, but they don't appear to be very effective in abating the nuisance of the stenches that arise whenever the manholes are opened at night.

AN IMPROVED BLACKING BOX.

A box to hold liquid blacking, and adapted to be readily applied to the ordinary dauber, permitting a supply of blacking to flow to the bristles of the dauber as desired, is shown in the accompanying illustration. It has been patented by Messrs. Paul G. Metzler and Roderic S. Davis, of No. 300 East Eighth Street, Leadville, Col. The blacking receptacle may be of tin or other metal, and has centrally of its bottom a downwardly projecting tubular outlet, the inlet opening at the top having a threaded cover fitting an exteriorly threaded collar. Within the receptacle at one side is journaled an angled lever arm, having an outwardly extending crank arm, a valve, consisting of a cork disk, being secured to the end of the lever arm, the cork being so mounted that by the turning of the crank handle it can be made to cover or uncover the outlet upon the bottom of the box. Wings are attached to the sides of the box at the bottom, by which the box may be readily secured to the dauber, a hole having been first made in the head of the dauber to receive the outlet tube formed in the bottom of the box.



METZLER AND DAVIS' LIQUID BLACKING BOX.

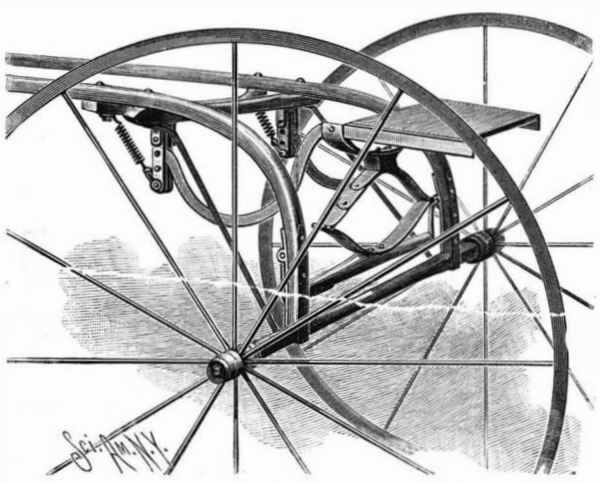
A FRENCH manufacturing firm has brought out a new fabric made of the fiber of ramie, and called ramie linen, that is said to combine the qualities of linen and silk, with double the strength of linen.

Gas at Sandy Creek, N. Y.

The Sandy Creek, N. Y., gas well is now over 700 ft. deep. This is 150 ft. below the point where the first signs of gas were struck. The rock is of the Trenton formation, and contains the remains of shells in abundance, which shows that this rock, now 700 ft. below the surface, was once on the surface and full of animal life. The Sandy Creek *News* says: "There is an abundance of gas, more than enough to run the engine, while at night it is burned from a 2 in. pipe and illumines the town. At a distance the burning gas appears as reflecting on the clouds like a large conflagration, and so extensive is the reflection that on a dark night the roads for a mile or two about the village are lighted by the flashes of the burning gas."

AN IMPROVED TWO-WHEELED VEHICLE.

A two-wheeled vehicle of simple construction, in which the seat may be adjusted to accommodate riders of different weights, and in which the "horse motion" will not be felt, is illustrated herewith, and has been patented by Messrs. James R. Parks and Jesse Kimball, of New Madrid, Mo. The thills are united near their rear end by a straight cross bar, and a curved brace bar in front of it, and from the under side of each end of the straight cross bar a brace rod is extended downward beneath the axle, the axle clips being passed through the ends of these bars. To the under face of each end of the straight cross bar is secured a downwardly extending bracket, to which perpendicular apertured plates are pivoted in pairs, the lower ends of these plates being connected by links and a spiral spring to the under side of the curved thill bar. Between each pair of apertured plates the inner ends of the curved seat-supporting bars are pivoted, the seat being attached to a horizontal rearward extension of the bars, and the inclination of the seat being varied at will by raising or lowering the pivotal point in the plates extending downward from the bracket. The seat bars are supported at the rear by a rocking bolster, suspended from crank arms turning in bearings formed upon the inner member of the axle clips, there being held on this bolster an elliptical spring with a head block, to which a semi-elliptical spring is fastened, the ends of the latter being secured to the horizontal section of the seat bars. Thus the seat is held upon springs adapted to flex vertically, and the forward ends of the seat bars are secured in bearings controlled by springs capable of flexing laterally, the seat being essentially independent of the axle.



PARKS AND KIMBALL'S TWO-WHEELED VEHICLE.

India Rubber.

Probably no article of merchandise has been studied so well with a view to adulteration as rubber. We have met with many samples of cotton goods wherein the added matter averaged half the total weight, but in a recent trial it has been proved that 55 per cent of foreign materials is not an uncommon thing to find in even what are considered good samples of commercial rubber. The rubber in question contained 45·27 of pure rubber and 54·73 of mineral matter in the hundred parts, the mineral ingredients being made up as follows:

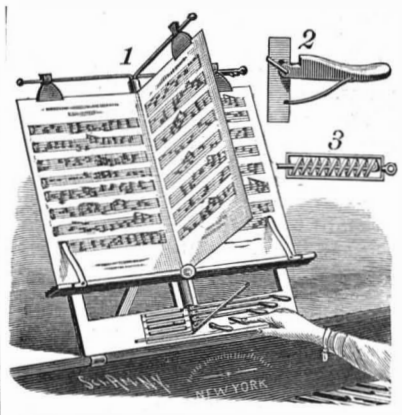
Whiting	20·75 parts.
Steatite	9·03 "
Barytes	6·70 "
Litharge	7·50 "
Sulphur	5·40 "
Lamp black	2·30 "

The vulcanization of this mixture with rubber was effected by heating for ninety minutes at 287° F., or equivalent to 40 pounds steam pressure.

Of course, we do not wish to infer that the mixing of the foregoing ingredients with rubber must necessarily be looked upon as a sophistication. There are many purposes to which pure rubber could not be applied; but seeing that the usual trade mixtures enable it to be put to such very diverse uses, consumers should be able to specify the exact kind they require. It is an acknowledged fact that the use of rubber has, to a large extent, been given up in chemical works, on account of the uncertainty of its longevity, and this notice has been prompted by the sight of a rubber cord that has preserved its original character very well after being in use 25 years; but it only contains 12 per cent of mineral matter.—*Chemical Trade Journal.*

AN IMPROVED MUSIC LEAF TURNER.

An invention designed to provide for the automatic turning of pages of music to be read at a piano is illustrated herewith, and has been patented by Lieut. Gianni Bettini, of No. 334 Fifth Avenue, New York City. The frame of this device centrally supports a tube in which a series of leaf-turning wire rods are held to turn, each rod having at its outer end a clip for holding the pages to be turned. These rods are bent out at right angles from the tube at the top and bottom to form arms, and, in connection with the bottom arms, springs, and spring-actuated pivoted fingers, shown in Figs. 2 and 3, are attached to the base bar of the frame, to engage and hold the arms in place, and turn them when released. In using this music turner, the several leaves of a piece of music are placed in engagement, successively, with the clips on the different arms at the top, and the lower horizontal arms corresponding therewith are brought to the right of the frame and engaged by the fingers, when, upon touching the first or lower finger, the first page will be turned, and then the second and third, etc., as the several fingers are pressed. Before repeating a page, the arm by which it is held is passed back to the right, and to repeat the whole piece all the arms are passed back together. An adjustable rest bar for supporting the music is held to slide vertically on the frame, and has near each end a pivoted stop of spring metal for retaining the divisions of the music in place, pressing them against the side bars of the frame.



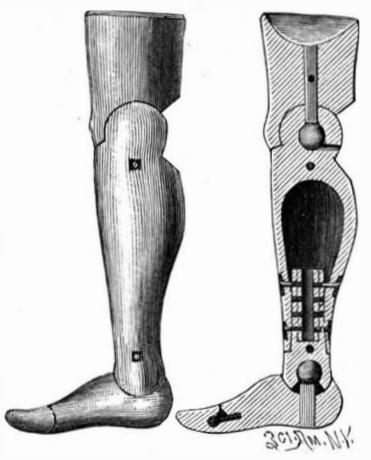
BETTINI'S MUSIC LEAF TURNER.

Ice in the Sick Room.

A saucerful of shaved ice, says the New York *Medical Times*, may be preserved for twenty-four hours with the thermometer in the room at 90° F., if the following precautions are observed: Put the saucer containing the ice in a soup plate and cover it with another. Place the soup plates thus arranged on a good, heavy pillow, and cover it with another pillow, pressing the pillows so that the plates are completely embedded in them. An old jack-plane set deep is a most excellent thing with which to shave ice. It should be turned bottom upward, and the ice shoved backward and forward over the cutter.

AN IMPROVED ARTIFICIAL LEG.

The accompanying illustration represents an artificial leg of strong and simple construction, designed to give a natural movement to each joint, and to be readily lengthened as desired, when used by those who have not yet attained their full growth. It has been patented by Mr. William L. Snyder, of No. 411 Mary St., North Denver, Col. The upper leg portion is formed with a curved recess and face plate to which a shank is secured, carrying at its lower end a socket ball, while the lower leg portion has a curved socket piece at the top fitting in the recess and having a socket for the ball. An ankle piece divided longitudinally is adjustably secured in the lower leg portion, and the foot piece has a ball joint resting in a recess or socket in the lower end of the ankle piece, the forward part of the foot piece being also provided with a ball joint, to allow for the bending of the foot. A metallic cylinder is arranged centrally within the lower leg portion, with perforations, in connection with screws extending through the leg portion into the shank and in the metallic cylinder, whereby the limb may be readily lengthened. The joints are made entirely of wood, and designed to work freely to give a perfect and natural movement, the parts being free from slides and iron straps.



SNYDER'S ARTIFICIAL LEG.

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THE BROOKLYN NAVY YARD.

The Brooklyn Navy Yard is the repairing station for all the government ships of the North Atlantic Squadron. It has a receiving ship for enlisting sailors, a barracks for marines, a thousand workmen turning out war material, ships bristling with guns ready for instant action, and a large ship building. The cries of officers to their men, the grind of great hawsers through swaying blocks, of stout-linked chains through hawse-pipes, the clank-clank-clank of lagging pawls around a windlass, the shrill piping of a boatswain in the tops, the blare of a bugle, and the never-ceasing rap-bang, rap-bang of hammer and sledge—such sounds assail the ear on every hand.

The approach to the navy yard by water is easy and pleasant, with clean-cut, well-kept passages to left and right. The approach on the land side is through narrow and uninviting streets, the entrance being about half a mile east of the Brooklyn end of the great bridge connecting that city with New York.

At the gate is a sergeant of marines, and sentries are pacing to and fro. Every entering stranger is stopped, passes being given to those who appear to be respectable visitors, while the loiterer or those who would smuggle spirits aboard the ships to the crews are turned away.

On an elevated plateau to the left of the entrance are the house and grounds of the commodore-commandant. The building is a modest wooden structure built before the war, and surrounded by elms, cottonwood, maples, and towering hedge. Here also are pear and apple trees, a finely trimmed lawn, and an old-fashioned garden.

The most prominent object in sight as you walk down the road from the entrance is an enormous hulk that looms up on the water line. It is the receiving ship Vermont, lying at the Cob dock. A little flat-bottomed boat, that works its way back and forth across the stream by means of a hawser stretched from shore to shore, ferries you across to a platform, whence it is only a few steps to the Vermont. Captain Beardsley commands the Vermont, receiving the crews of incoming ships when they are not needed aboard and organizing new companies for ships newly put in commission.

At the northeastern end of the Cob dock is the ordnance dock. Here is an enormous crane for lifting guns out of and lowering them into a ship's battery. Near by are rows of big guns resting upon rollers. Some are old-fashioned 9 inch smooth bores, others are 15 inch in caliber, with rifled cylinders set within—an old-time makeshift; and again there are the new steel rifles, 30 feet long, with 8 inch bores, and, when set up on the ships' decks, each having a great steel curtain or hood to protect the gunners from an enemy's fire, the gun projecting through.

A fleet of old-fashioned, worn-out, or dismantled craft lie about the eastern side of the Cob dock. Ericsson's Destroyer, her terrible submarine torpedo lashed upon her forward deck, creaks and frets at her hawsers, as though impatient to be off at her work of destruction. Then there's the Alarm, a long, narrow, sharp-stemmed, rakish-looking craft, for which great things were promised but little realized.

A monster submarine boat, lying upon a grassy bank, looks like the egg of some antediluvian reptile waiting to be hatched. Its inventor proved practically to the naval authorities that his boat could navigate in the sub-current, and then, the government showing no disposition to buy, left this massive monument to unrewarded skill and forgot to call for it. There's the old monitor Nantucket, her half-submerged decks surrounded by vagrant logs drifting to and fro against her, though once, with full steam up, she burst a boom of logs and chains and, passing a nest of belching forts, made the open sea. Perhaps the most curious sight in the yard are two ships partly built and then suffered to rot and rust away, the appropriation failing.

There are two ship houses in the yard. One contains a fleet of ships' long boats, cutters, gigs, and dingies, the other the growing skeleton of the armored steel cruiser Maine. When completed this ship will be of 6,648 tons displacement, have twin screws, and carry a battery of ten guns. A description of the work of construction of this ship is left for a future article, only the work of the yard shops as illustrated by the preparation of the parts for fitting to such a construction being here touched upon. The work on the bending of slabs [see Fig. 5] is highly interesting, showing as it does how, even in so ponderous a construction as a steel cruiser, every plate and angle iron must be fashioned in exact accordance with the lines, exaggerated, of course, of a model which a man can carry under his arms; how, indeed, every curve is known and calculated long in advance, the drawings so perfect that the artisan has little or no thinking to do, and only to follow the lines as they are furnished. In the forge and furnace house, the angle irons that are to be employed to steady, and in some cases to support, the frames are heated over an immense grate, being then fetched upon a series of cast iron bending slabs [see Fig. 4]. These slabs are solid and smooth, being put together with great care, for, when uneven, the ill effect, though barely apparent in some cases, increases the labor of putting together materially, often requiring much refitting and a deal of filing and extra hammering. Along these bending slabs there are a series of holes running up and down and criss-cross, so that, when the curve that it is desired to give a piece of heated iron be chalked out, it will be sure to intercept a number of holes in which the steel pins are placed to brace the piece requiring bending, for here they are to get their corrected shape. Long before this, chalk lines and curves have been marked out, and the wooden moulds cut out in compliance with the drawings of the original plan. Along the chalk lines, and following them closely, steel pins are inserted in the slab, the same being perforated to suit any designing. Levers and sledge hammers are used and the frame forced around until it is in exact agreement with the chalk line already referred to. The keel plates are heated in the same manner. In Fig. 5, four men are bending an angle bar on the slab, a work requiring a quick eye and a ready hand, for, as is immediately obvious, the quicker the bar is bent the easier, because it stiffens as it cools. As will be seen, two men are prying with a lever, a third one hammering the piece into place, while, as the shank answers to the force, a fourth man puts in the restraining pins along the chalk line already marked.

In the roller house [see Fig. 3] the great plates, before they are punched for rivets, are smoothed out, being run through two enormous iron rollers resembling not a little two ponderous road rollers put together and revolving both in the same direction, one over the other, with a long broad plate of steel between them. These are stopped or set moving by a shut-off wheel, easily worked back or forth by a single movement of the hand. In Fig. 3, a plate is being straightened in the rolls after passing once through. It will be passed back again to make sure work of any elastic knobs that may exist. Fig. 2 represents the work of punching the plates for riveting, one requiring more care than would seem at first sight, for it is absolutely necessary that the punching be true and the subsequent riveting perpendicular to the plates. A carefully trained hand operates the punch, while another keeps the oiler going. Then comes countersinking, as will be seen in the illustration—a work that follows punching. The plates are seen resting upon cannon balls, and, because of this ingenious contrivance, can be moved readily by one man, although some of them weigh several tons each.

Perhaps the most interesting point in the navy yard is the moulding loft. Here, after a miniature wooden ship has been fashioned to correspond with the lines of the one to be built, these lines, exaggerated to the proper dimensions, are then drawn off on the floor. Very careful work this must be, and very nice calculations, for wooden moulds must be prepared from these, giving the exact size and shape of the angle irons (frames) and plates for the iron and steel workers to use in preparing for actual construction.

The work of fitting these patterns also requires cunning skill. First the outline of the keel, or rather the two keels, for steel ships have now two bottoms instead of one, so that they can scrape and break once on the rocks and still run off dry. After the lower strakes, midship section, after section, stern-post, then forward, starboard, port, fore-foot, bows. That is about the order they come in, remembering, of course, that the angle irons, that is to say, the frames, come first and the plates afterward.

In this moulding loft are kept the patterns of all ships that have been built here for the navy for many years; indeed, here are the plans of some of those famous wooden ships that were built immediately after the close of the naval war of 1812–13, and patterned after those great warriors. Those familiar with the history of that war will remember that our small fleet, which many thought should be sunk to escape from capture by the enormous fleets of the British, was, instead of this, taken out and fought for what it was worth. They will remember that the handiness of the ships and their superiority to those of the British was quite as much a surprise at home as abroad.

The plumbers' shop has more work than it can do just now, and doubtless will soon be much enlarged, Secretary Tracy having included it in his estimate of needed appropriations. Here are made the repairs to the network of pipework on the new ships. There are the pump connections with the various apartments, the boiler and heat and pressure connections between engine and fire and boiler rooms and engineer's room, besides scores of other uses for which pipes and piping and electrical wiring is required.

Over by the marine barracks, near the southern gate, is an interesting study of anchors; an hundred or more of these, all of mammoth size, being strung up on anchor racks. There is to be seen the bower anchor with its stationary flukes, the great kedge with its bar pushed through the shank and neatly lashed, the sheet anchor with its ponderous limbs, and the mushroom for securing a permanent buoy, thus enabling a ship to have an easy and quick means of making fast to, and casting off from, a permanent holding, on station.

This being the repair and refitting yard of the North Atlantic Squadron—the Boston yard has now become only an equipment center, where naval supplies, such as chains, anchors, rope, etc., are made—there is a large force of workmen kept busy at all times, the number on the books just now approaching one thousand. Ships remain on a station three years, cruising being a part of the duty. Sometimes they remain still longer away from homes—the Lancaster, for instance, which arrived at the yard recently, has been absent for eight years, having been the flag-ship of the European Squadron. When a ship is put "out of commission," her crew are discharged; that is to say, those of them whose enlistment has not expired are sent to the receiving ship, her officers assigned to duty elsewhere, and the ship handed over to the officers of the yard, who proceed to make a survey of her condition. If ship-rigged, like the Lancaster, her royal masts, topgallant masts, and topmasts, are sent down, the yards going with them, and everything, even to anchors and chains, being taken out, "dismantling," it is called. If the estimate for the repairs to the hull amounts to more than 20 per cent of the total cost of the ship, an act of Congress forbids the expenditure—if she is a wooden ship. In the case of an iron or steel vessel, it is not yet decided what the limit of expense shall be for repairs. In refitting, every part of a ship's rigging or furnishings that is badly worn or strained, or likely to give out, is renewed, so that, when again she sets out, she is, practically speaking, a new ship.

There is one dry dock at the yard, a stone one, or rather there are two, for another, a great wooden one, 500 feet long, is almost completed. In its present stage it looks like the pictures of the Theater Maximus, somewhat fore-shortened, there being series upon series of steps and lookouts from the top copings to the deep sunken pit where the workmen look like pygmies. In this the larger ships will be able to come, the stone dock having been completed as long ago as 1833, when ships were very much smaller than at present.

A movement is now afoot to greatly enlarge the scope and capacity of the yard, Secretary of the Navy Tracy having determined to remodel many departments. He has appointed as a Board of Permanent Improvement, Admiral Braine, Henry S. Craven, C.E., and P. C. Asserson, C.E. This board has now been sitting nearly three months and its report will soon be ready. In this it is recommended that all parts of the refitting and manufacturing plant now in the yard shops which is not of the newest and most improved patterns be discarded and modern apparatus be set up in its place. The determination of the secretary to make this a first-class yard will also necessitate a very considerable increase in plant. Likely enough it will be doubled, notably the foundry and machine shop capacity, which, for a long time, has been felt to be much too small and incapable of doing its part.

The officers of the yard are: Commodore-commandant Ramsay; Department of Construction, J. B. Hoover and J. J. Woodward; Department of Equipment, Commander Whiting; Department of Steam Engineering, Chief Engineer Dungan; Department of Navigation, Commander Green; Department of Civil Engineering (yards and docks), Henry S. Craven, C.E.; Department of Provisions and Clothing, Pay Inspector Tolfrey; Board of Inspection, Commander Graham; Commander of receiving ship Vermont, Captain Beardsley.

Treatment of Pneumonia by Application of Ice.

Dr. Fieandt, writing in *Duodecim*, a Finnish medical journal, states that he has now treated no less than 106 cases of pneumonia with ice, and with the best results. Though ten of the cases were of double pneumonia, only three out of the whole number succumbed, notwithstanding that the epidemic was by no means a slight one. The method adopted was to apply over the affected lung an India-rubber bag containing ice continuously for from twelve to twenty-four hours after the crisis. In addition to the local treatment the patients were given such medicines as are usually employed, that is to say, opium, ipecacuanha, digitalis, brandy, etc. The method has, we may remark, received of late some attention in this country.—*London Lancet.*

A Pump Operated by Waves at Ocean Grove, N. J.

In the spring a pier was begun at this watering place on the Atlantic coast of New Jersey, having eight gates, each of which swung upon a steel rod, so that the lower part of each gate would be submerged about two feet at low tide and seven feet at high tide. Each gate is thirteen feet long, and at its top is attached a rod serving as an angle bar for the piston rod of a force pump, the force of each wave sufficing to effect a stroke of the piston, and the pump being used to elevate water from the ocean to tanks that are forty feet high. It is said that on one day, recently, when the surf was by no means heavy, 40,000 gallons of water were thus raised to the tanks. The water is used for sprinkling the streets.

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Correspondence.

How to Make Cider Ferment and Produce Vinegar.

To the Editor of the Scientific American:

Advise your correspondent, H. L., of query No. 1187, to put a package of Horsford's bread-raising preparation to each barrel and put in the sun, and it will ferment; at least I did that to some of mine which would not work, and it made some of the finest and whitest vinegar I ever saw. I formerly tried mother, yeast, alcohol, raisins, etc., without effect. I should like to have him let me know how he succeeds.

R. M. HOYLE.

Norwood, Norfolk County, Mass.

The Rabbit Grub.

To the Editor of the Scientific American:

I was interested and amused at reading Mr. Hiram M. Howard's article about the "Rabbit Grub," in your paper of 31st ult. Mr. Howard seems to have wondered at the grub being found in the skin of the rabbit, especially the old ones. To one who has made the nature and habits of the rabbit a study, it is so common to find the grubs that they are not noticed with any interest. The writer was raised on a farm in Franklin County, N. C., where the rabbit is as plentiful as anywhere in the State, and from my earliest recollection of the rabbits, I have found these grubs, which *we* called "wolves." They do not confine themselves to the old, but are as common in the young rabbits from the time they leave the bed till frost and cold weather, when they are never found, though the scars can be seen in the skin. The grubs are often found in clusters of three. I have cut out of a young rabbit not larger than a full-grown rat three hanging in a kind of sack between the hind legs, and they are as apt to be found in one place as another. If Mr. Howard had waited a few minutes after killing the rabbit, he would have seen the grub crawl out, as they will not remain long after life is extinct. I do not know whether the grub habitually attacks the white and black or spotted rabbits raised in pens or not, but on one occasion we had some of these pet rabbits on the farm, which were troublesome to keep up, and on turning them loose in the yard and garden, the grubs attacked them, and some died, apparently from the effects. Trusting these remarks may throw some light on the subject, I am yours truly, C. W. HUNT.

Editorial office of the Burlington *News*,
Burlington, N. C.

The Causes of Insanity.

An interesting table showing the assigned causes of insanity in the cases of all patients admitted into public and private asylums in England and Wales during the ten years 1878–87 is given in the report of the Commissioners in Lunacy just issued. These causes are not taken from the statements in the papers of admission of the patients, but are those which have been verified by the medical officers of the asylums. The total number of admissions during the ten years was 136,478, being 66,918 of the male and 69,560 of the female sex. The totals in the following table exceed the whole number of patients admitted, as in some cases there was a combination of causes.

Causes of Insanity.	Male.	Female.	Total.
MORAL:			
Domestic trouble (including loss of relatives and friends)	2,787	6,782	9,569
Adverse circumstances (including business anxieties and pecuniary difficulties)	5,493	2,567	8,060
Mental anxiety and "worry" (not included under the above two heads); and overwork	4,435	3,843	8,278
Religious excitement	1,693	2,076	3,769
Love affairs, etc	456	1,768	2,224
Fright and nervous shock	639	1,314	1,953
PHYSICAL:			
Intemperance in drink	13,286	5,004	18,290
Sexual diseases	2,684	763	3,447
Over-exertion	449	312	761
Sunstroke	1,557	129	1,686
Accident or injury	3,497	702	4,199
Diseases of women	—	11,315	11,315
Puberty	170	412	582
Fevers	489	391	880
Privation and starvation	1.112	1,495	2,607
Old age	2,568	3,205	5,773
Other bodily diseases or disorders	7,420	7,299	14,719
Previous attacks	9,565	13,138	22,703
Hereditary influence ascertained	12,703	15,360	28,063
Congenital defect ascertained	3,461	2,420	5,881
Other ascertained causes	1,584	738	2,322
Unknown	14,286	13,985	28,271

The total number of lunatics, idiots, and persons of unsound mind in England and Wales on January 1 last was 84,340, being an increase of 1,697 on the figures of the previous year. The ratio to the whole population has arisen from 28·87 to 29·07 per 10,000, which is the highest point at which it has stood. The rate of recovery to the admissions is calculated at 38·71 per cent.

MESSRS. HENRY CAREY BAIRD & CO., of Philadelphia, industrial publishers, have been awarded a bronze medal at the Paris exposition for the excellence of their technical books.

TANGENT GALVANOMETER.*

The tangent galvanometer is of great importance in electrical measurements, especially in the class relating to currents. The principle of the instrument is illustrated by Fig. 1. In a narrow coil of wire is suspended a short magnetized needle, whose length does not exceed one-twelfth the diameter of the coil. Two light pointers are connected with the needle at right angles thereto. When a current is sent through this coil, the needle is deflected to the right or left, according to the direction of the current, and the amount of deflection is dependent upon, but not proportional to, the strength of the current. It is, however, proportional to the tangent of the angle of deflection.

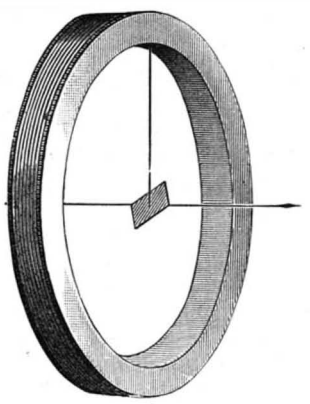

Fig. 1.—PRINCIPLE OF TANGENT GALVANOMETER.

A practical tangent galvanometer is shown in Fig. 2. In this instrument the conductor is wound upon a grooved wooden ring 9 inches in diameter, the groove being ¾ inch wide and 1 inch deep. The wooden ring is mounted in a circular base piece, which is pivoted to the lower base to admit of adjustment. The lower base is provided with three leveling screws, which are bored longitudinally to receive pointed wires, which are driven into the table to prevent the instrument from sliding. The lower base is provided with an angled arm, which extends over the upper base piece, and is provided with a screw for clamping the latter when adjusted.

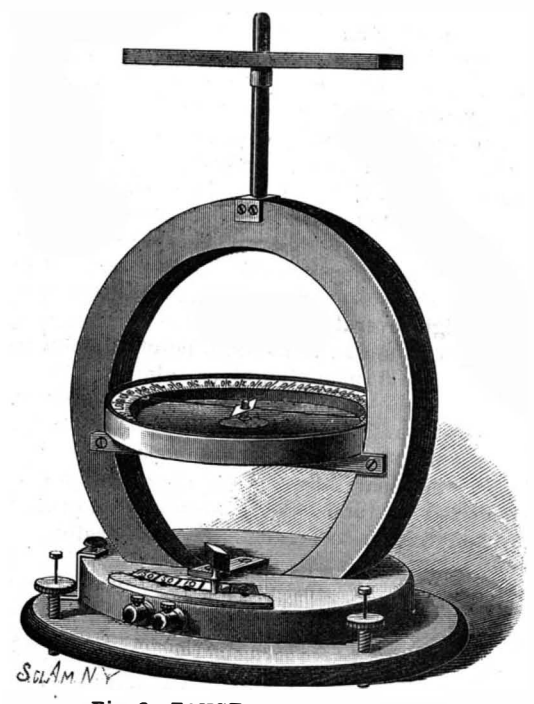

Fig. 2.—TANGENT GALVANOMETER.

The winding of the ring is divided into five sections having different resistances, so that by means of a plug inserted in the switch on the base the resistance may be made 0, 1, 10, 50, or 150 ohms.

Fig. 3 is a diagram showing the coils and the switch connection stretched out. The first coil, *a*, is a band of copper ¾ inch wide and $\frac{1}{16}$ inch thick, with practically no resistance. The other coils are of iron. The coils, *b* and *a*, together, have a resistance of one ohm. The coils, *c*, *b*, *a*, have a combined resistance of 10 ohms. The coil, *d*, together with the preceding, offer

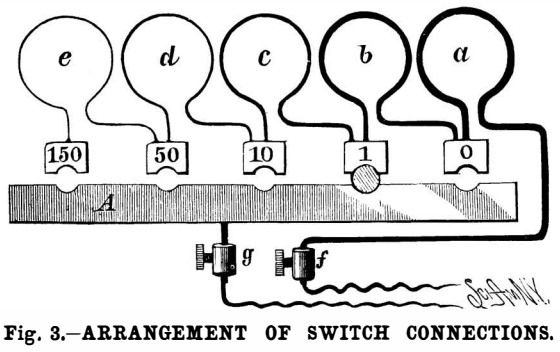

Fig. 3.—ARRANGEMENT OF SWITCH CONNECTIONS.

a resistance of 50 ohms, and the combined resistance of all of the coils, *e*, *d*, *c*, *b*, *a*, is 150 ohms.

The conductors are connected with the binding posts, *f g*, and the current flows through the coils in succession, until it reaches one of the smaller switch plates, which is connected with the plate, A, by the plug. In the present case the plug is inserted between the plate marked 1 and the plate, A, causing the current to flow from the binding post, *f*, through the coils, *a*, *b*, and plate, A, to the binding post, *g*. The resistance of the galvanometer is obviously 1 ohm.

The magnetic needle, which is ¾ inch long, is located exactly at the center of the ring, and delicately poised on a fine hard steel point. The needle should be jeweled to reduce the friction and wear to a minimum. To the sides of the needle are attached indexes of aluminum having flat ends, each of which is provided with a fine mark representing the center line of the index. The box containing the scale and the needle is supported by a cross bar attached to the wooden ring. To the top of the wooden ring is attached a brass standard, which is axially in line with the compass needle.

Upon the standard is mounted a bar magnet, which may be adjusted at any angle or raised or lowered. This magnet serves as an artificial meridian when the galvanometer is used for ordinary work. When it is used as a tangent galvanometer the magnet is removed.

The tangent galvanometer must be arranged with the coil and the needle in the magnetic meridian, and its adjustment must be such that a current which produces a certain deflection of the needle in one direction will, when reversed, produce a like deflection in the opposite direction. The angle of maximum sensitiveness in the tangent galvanometer is 45°; therefore, when it is possible to do so, the current should be arranged to produce a deflection approximating 45°.

The resistance of a battery may be ascertained by means of the tangent galvanometer as follows: The battery is connected with the galvanometer, and the deflection of the needle is noted; then a variable resistance is introduced and adjusted until there is a deflection, the tangent of the angle of which is equal to one-half the tangent of the angle of the first deflection. The resistance thus introduced is equal to that of the battery and galvanometer. Take from this quantity the resistance of the galvanometer and the remainder will be the resistance of the battery.

For example, when a battery placed in circuit with a tangent galvanometer produces a deflection of 48°, the tangent* of that angle being 1·111, half of this quantity would be 0·555, which is very nearly the tangent of the angle of 29°; therefore, resistance is introduced until the needle falls back to 29°. Assuming this resistance to be 15 ohms, and the resistance of the galvanometer to be 10 ohms, the galvanometer resistance deducted from the resistance introduced leaves 5 ohms, which is the resistance of the battery.

To measure the electromotive force of a battery a standard cell is necessary. A Daniell or gravity cell, having an E. M. F. of 1·079 volts, is commonly used. This is connected with the tangent galvanometer, and the deflection and total resistance in the circuit, which must be high, is noted. The standard battery is then removed and the one to be measured is inserted in its place, and the resistance of the circuit is adjusted until the deflection of the galvanometer needle is the same as in the first case. It now becomes a matter of simple proportion, which is as follows:

E. M. F. of standard battery.	:	E. M. F. of battery being measured.	: :	Total resistance in first case.	:	Total resistance in second case.

Assuming the resistance in the first case to have been 2,500 ohms, and that in the second case 2,000 ohms, the proportion would stand thus:

1·079 : Unknown E. M. F. : : 2,500 : 2,000

or as 5 to 4. The E. M. F. of the battery measured is therefore 0·8632 volt.

A convenient arrangement of the tangent galvanometer scale is to have one side of the scale divided into degrees, the other side being arranged according to the tangent principle, so that the reading will be direct and reference to the table of tangents will be avoided.

The simplest method of measuring resistance is that known as the substitution method, in which the unknown resistance and a galvanometer are placed in the circuit of the battery; the deflection of the galvanometer needle is noted. A variable known resistance is then substituted for the unknown resistance, and adjusted until the deflection is the same as in the first case. The variable known resistance will then equal the unknown resistance. If the current is so great as to cause a deflection of the needle much exceeding 45°, it should be reduced either by removing some of the battery or by the introduction of extra resistance into the circuit. The same conditions must obtain throughout the measurement.

SIR WILLIAM GULL says that when fagged out by professional work he recruits his strength by eating raisins, and not by drinking wine or brandy.

Another good saying from the same source: A pint of warm water, taken on an empty stomach in the morning, is the safest and surest of all remedies for habitual constipation. It dissolves the fecal matter and stimulates peristaltic action, thereby giving a normal action without pain. If the tongue is coated, squeeze a lemon into the water and drink without sweetening.

* From "Experimental Science," by Geo. M. Hopkins. In press. Munn & Co. publishers, New York.

* A table of natural tangents may be found in almost any engineer's hand book.

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THE PARIS EXHIBITION.

THE STATIONARY ENGINE EXHIBITS.

PARIS, August 25, 1889.

In a former letter I mentioned that there were but few high speed engines in the Palais des Machines, and of one of those I now forward drawings, from which it will be seen that it is a vertical engine (of 150 horse power), and having a wheel governor actuated by a spring, and having a cataract oil cylinder to steady the governor action. Fig. 1 shows the cylinder, valve,

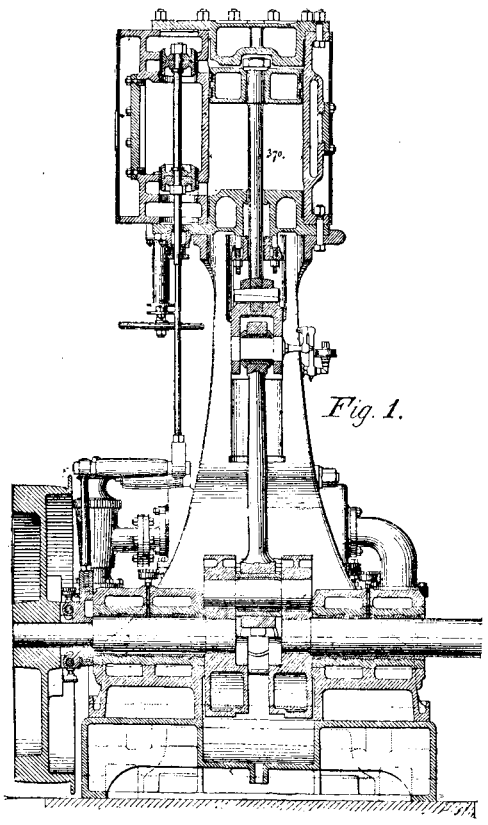

Fig. 1.

crosshead, connecting-rod bearings, and the main bearings and wheel governor in section. A front elevation of the engine is shown in Fig. 2, the governor wheel and spring being shown dotted in. The construction of the piston valve is shown in Fig. 5, and it will be seen that it is made in two parts, held together by means of a nut, and it follows that this affords means (by letting the two halves of the valve come together) of adjusting the edge fit of the packing rings.

A single packing ring is employed, extending nearly the full width of each valve. The construction of the wheel governor is shown in Figs. 3 and 4, in which it is seen that the eccentric is moved across the shaft in a direct line instead of in the arc of a circle, as is often the case. The weight, *a*, is secured to the spring, *b*, and to the eccentric piece, *c*, so that the weight of *a*, of *b*, and all that part of the eccentric that is on the spring side of the center of the shaft acts by its centrifugal force to pull the eccentric across the shaft, thus reducing its throw, and therefore the travel of the valves, thus causing the live steam to be cut off earlier in the piston stroke and to be used more expansively. In opposition to this we have the tension of the spring, *b*, the weight of the cataract and of all that part of the eccentric on the other side of the shaft center, tending by centrifugal force to keep the eccentric at its full throw, and therefore to keep the valve travel at its maximum and prolong the live steam period. When the engine is running at its proper speed, the position of these contending weights is such that they counterbalance each other. The tension of the spring is adjusted by the screw, *f*, which is secured in its adjusted position by the set screw, *g*.

The cataract, *e*, is shown in Figs. 3 and 4, and it is seen in Fig. 4 that there is a port through the piston for the oil to pass through and an adjusting screw, *h*, for the piston rod.

A beautifully made engine is exhibited by Sulzer Freres, of Winterthur. It is a vertical triple expansion engine, but they have neither catalogue nor drawings of it. The valve gear is driven by bevel gear from the crank shaft, a vertical shaft on which the governor is placed extending upward and driving a horizontal shaft for the valve gears for each cylinder. The governor is of the Porter type. The Societe de Construction, of Bale, have quite a large representation of stationary engines here in their several separate exhibits, and among them I notice a form of engine that in principle is very old, but does not seem to long survive in any of the forms in which it is made. The essential feature is two pistons working in one cylinder, the pistons meeting in the center. Bodmer was the original inventor of the double piston motion, and he embodied it in the celebrated locomotive bearing his name. Such an engine is in a certain way more balanced than other forms of engine, because it puts no strain on the foundation of the engine, which is as it were self-contained, so far as the strain is concerned. The most successful of this class of engine, so far as I know, is the Wells engine, patented in America. Of course there is not, nor can there be, any gain of power over that of a single piston cylinder using the same amount of live steam.

In a wheel governor engine exhibited by the Ateliers de Construction d'Oerlikon, Zurich, Switzerland, the main valve is worked positively by a fixed eccentric, and the cut-off valve by a shifting eccentric actuated by the wheel governor.

One valve spindle works through the other, which is hollow for the purpose, and the most notable detail about the engine is the happy manner in which this is accomplished; the eccentric rods and all the connections being straight and plain, with no cranks, twists, or turns in any form about them.

A compound horizontal engine exhibited by the Societe Alsatienne de Constructions Mecaniques, Bel-

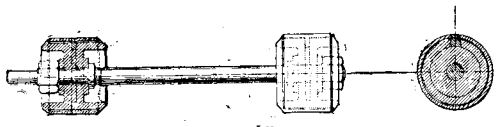

Fig. 5.

fort, has a Porter-Allen bed plate and guide bars and a wheel governor. A second engine in this same exhibit is a compound one in which the high pressure cylinder is placed on top of the low pressure one, but at an angle of about fifteen degrees to it.

This form of design attracted a good deal of attention from the American visiting engineers on board the steamboats that ply across the English channel, all these boats using that class of engine; both connecting rods on this engine, however, connect to the same crank pin, whereas on board the boats a floating crank as it may be called is employed to connect the two crank pins together. A Porter governor is employed. A compound engine by the Societe de Constructions Mecanique, Bale, has a trip valve motion for the high pressure cylinder and a Meyer adjustable cut-off valve motion for the low pressure cylinder. The pistons for both cylinders have tail rods extending through the cylinder covers, and a notable feature is that these tail rods are protected from the cold air by a long copper tube casing that is supported by the gland.

JOSHUA ROSE.

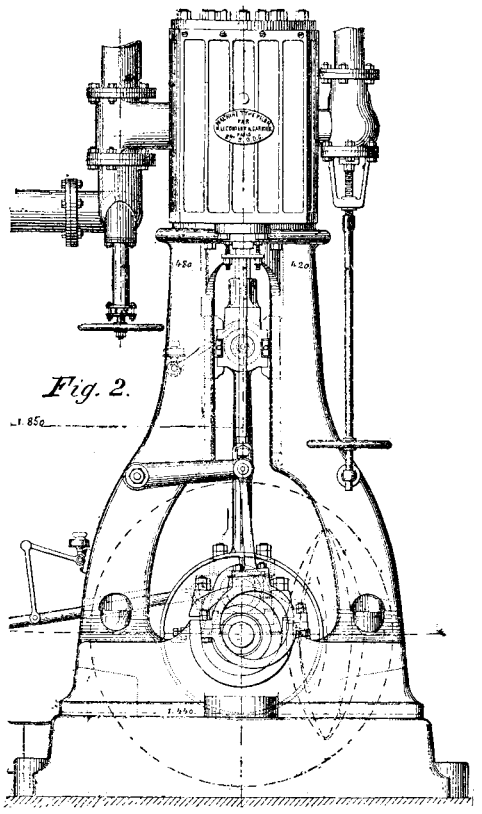

Fig. 2.

Eel Skins for Rheumatism.

Eel skins for rheumatism. It is a quaint idea, and sounds a good deal more like an ancient and exploded superstition than the accepted remedy of sensible men. Nevertheless eel skins are largely in demand, and a great many people in various parts of the country wear the dried skins as fully accredited cures for rheumatism. A *Pall Mall Budget* reporter the other day paid a visit to Billingsgate and made some inquiries. One of the largest eel dealers in the great London fish market was seen, and at once gave some interesting information on the subject.

"Well, you know," he said, "we don't skin eels here. We sell them in quantity and alive. All the same, I have heard a good deal about the employment of eel skins for the cure of rheumatism, and though I have never used them myself, for I am thankful to say I do not suffer from the complaint, I do know of numbers of cases in which they have been used with complete success. Our men are often asked to get a few skins, and they send them to all parts of the country. They get a few pence or a tip of some kind for a bundle of skins, but I don't think there is any regular trade in them."

"How are the skins used?"

"They are stretched on a board and dried, in the first place, then, to make them pliant, they are slightly moistened and tied around the suffering limb. They are worn as garters, anklets, bracelets, and armlets. They are even woven around the waist—next to the skin of course—for lumbago and sciatica"

"Can you tell me what is supposed to be their special virtue?"

"No; except that they are effectual. Hundreds of London cabmen wear them, and swear by them, and I have a number of gentlemen customers in the country who ask me to send them eel skins to give away to the poor people of their districts. Persons who have once worn them will never be without them if they can help it. But I cannot tell you what medicinal property they possess. Perhaps after all it is only warmth, for of course they must form an almost air-tight bandage, like a piece of gutta percha or gold-beater's skin. Perhaps it is only fancy, and that goes a very long way, as you probably know. Why, I have heard that a skein of silk tied round the waist will cure lumbago, or round the knee will cure rheumatism in the leg. Now, what earthly medicinal property can there be in a skein of silk? Of course the skins are generally considered as refuse or offal, and are consequently thrown away."

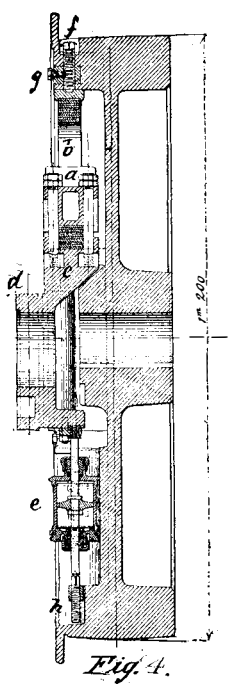

Fig. 4.

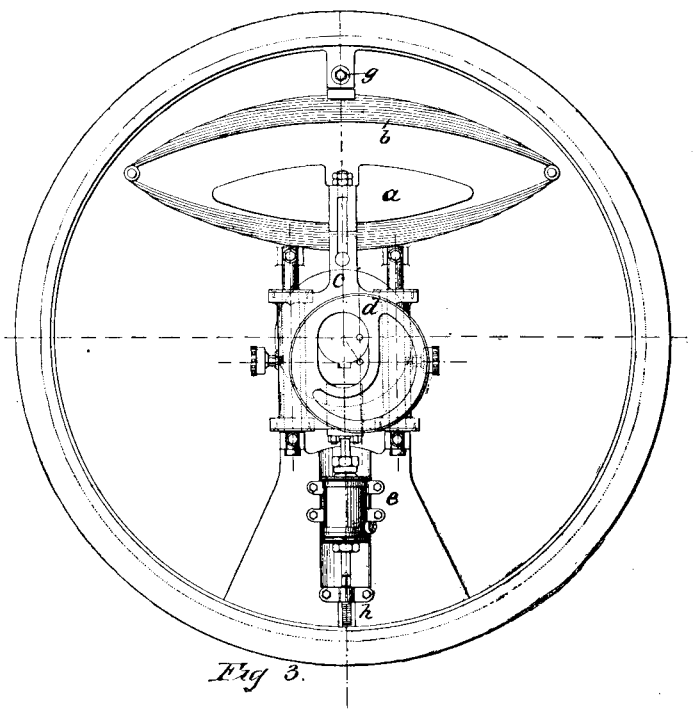

Fig. 3.

Bleaching Tallow.

In order to bleach tallow to a good color, the following process may be employed: The bleaching mixture or "chemick" is made by taking 40 lb. of finely ground black oxide of manganese, and adding to it two carboys of water, then gently pouring in two carboys of oil of vitriol of 150° Tw. at intervals, finally diluting to 64° Tw. with water.

In order to bleach the tallow, it must be melted by means of steam. When it is at full boiling heat, add about two gallons of the above "chemick," pouring it gently in, in order that it may not sink to the bottom. When the tallow boils quickly, the "chemick" is prevented from sinking, and is evenly disseminated throughout the whole batch. When thoroughly bleached, turn off the steam, and allow to settle, then run off the tallow into another vat, and wash it well by giving it a good boil up with water. A better mixture than the above, which is an old receipt, in use in several large works, may be made by taking 50 lb. of Tennants' recovered manganese, instead of the finely ground black oxide; it is lighter, and therefore the tendency to sink in the melted tallow is not so great.—*Chem. Tr. Jour.*

THE tensile strength of a wet rope is found to be only one-third that of the same rope when dry, and a rope saturated with grease or soap is weaker still, as the lubricant permits the fibers to slip with greater facility. A dry rope twenty-five feet long will shorten to twenty-four on being wet.

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THE FIRST GALLERY OF THE EIFFEL TOWER.

On the first platform of the Eiffel tower restaurants have been established where visitors can rest and refresh themselves and enjoy a magnificent view of Paris and its suburbs. The level of this story is marked by a bold frieze, on the panels of which, around all four faces of the tower, are inscribed, in letters of gold, the names of the famous Frenchmen of the century who have most contributed to the advancement of science. Above this frieze is a four-sided arcade, firmly supported by brackets, covering an exterior gallery, as shown in our illustration, made by instantaneous photography, where those stopping at the first platform can have the opportunity of making a complete circuit of the tower. A similar arcade encircles the tower at the level of the second story.

Although there are spiral staircases leading around the columns and riveted thereto, not many have a sufficiently strong head to stand the continual going round and round, with nothing but the thin hand rails to keep one from falling off on either side. There are four elevators leading to the first platform, two of the Otis pattern, carrying 50 passengers each, and moving at the rate of two meters a second, and two of French design, carrying 100 passengers each, and traveling one meter a second. The tower is painted a rich chocolate color, the tone of which is lightened from the base toward the summit, and all its outlines are well set out when lighted up by the sun. The entire height of the tower is 984 feet.

THE FIRST GALLERY OF THE EIFFEL TOWER.

The Sources of Beautiful Colors.

The *American Druggist* has formulated a list of the choicest colors used in the arts, as follows:

The cochineal insects furnish a great many of the very fine colors. Among them are the gorgeous carmine, the crimson, scarlet carmine, and purple lakes. The cuttlefish gives the sepia. It is the inky fluid which the fish discharges in order to render the water opaque when attacked. Indian yellow comes from the camel. Ivory chips produce the ivory black and bone black. The exquisite Prussian blue is made by fusing horses' hoofs and other refuse animal matter with impure potassium carbonate. This color was discovered accidentally. Various lakes are derived from roots, barks, and gums. Blue black comes from the charcoal of the vine stalk. Lamp black is soot from certain resinous substances. Turkey red is mud from the madder plant, which grows in Hindostan. The yellow sap of a tree of Siam produces gamboge; the natives catch the sap in cocoanut shells. Raw sienna is the natural earth from the neighborhood of Sienna, Italy. Raw umber is also an earth found near Umbria and burnt. India ink is made from burnt camphor. The Chinese are the only manufacturers of this ink, and they will not reveal the secret of its manufacture. Mastic is made from the gum of the mastic tree, which grows in the Grecian Archipelago. Bister is the soot of wood ashes. Very little real ultramarine is found in the market. It is obtained from the precious lapis-lazuli, and commands a fabulous price. Chinese white is zinc, scarlet is iodide of mercury, and native vermilion is from the quicksilver ore called cinnabar.

New Shops of the Long Island Railroad.

The new shops of the Long Island Railroad Co., near the village of Jamaica, which were commenced in February last, are now practically completed, and *The Railroad Gazette* says the formal removal of the works from their present location at Hunter's Point will probably take place on or about November 1.

The new buildings are of red brick, with granite foundations and trimmings. They consist of two large main structures, running north and south, respectively 547x85 ft. and 420x100 ft.; a blacksmith shop 100x60 ft.; a boiler house 35x45 ft.; an engine room 26x45 ft., and a store and pattern room, all separated from each other. The larger of the two main structures comprises a paint shop, 239 ft. long, capable of accommodating 14 cars; a car shop, 214 ft. long, and a mill room, 89 ft. long, where the lumber will be prepared. These three shops are the full width of the building, 85 ft., and the height to the center of the roof is 30 ft. The flooring consists of combined Trinidad and Neufchatel asphalt pavement.

The machine shop, 420 ft. long and 60 ft. wide, with an annex 40 ft. wide running the entire length, has accommodations for 16 locomotives, and is fitted up with two traveling cranes with a joint capacity of 50 tons, furnished by the Morgan Engineering Company, of Alliance, O. Two driving shafts will run the entire length of the building, one for the machinery and the other for the cranes. A boiler shop is located in the north end of the annex. The smith's shop will contain a large furnace, two steam hammers and thirteen forges, and will be fitted up with exhaust flues for carrying off smoke and heat. The boiler house will contain three 75 horse power boilers built by the Bigelow Company, of New Haven, Conn. These boilers will supply steam for heat as well as power. Adjoining the boiler house on one side is a large building for a coal bin, and so fitted that the coal will drop into it from the cars, which will be run on a trestle overhead. On the other side of the boiler house, and really part of it, is a large building for an electric light plant. The shops will be lighted by electricity whenever it may be necessary to work at night, or in the winter time when the days are short.

Three 225 horse power Westinghouse automatic engines will drive the machinery in the several departments. Between the boiler house and smith's shop stands a 125 ft. chimney. Between the two main buildings will be a 78 ft. transfer table supplied by the Yale & Towne Manufacturing Company, of Stamford, Conn. A roundhouse to take in 50 engines is also to be built. Much of the machinery at present in use at Hunter's Point will be transferred to the new works, but a large quantity of new and improved machinery is to be put in. It will be supplied by Manning, Maxwell & Moore, of New York.

While the new works will not be the largest in the country, they will be among the most complete in design and appointments. The total cost will be about $175,000. The contract for building them was given to the Flynt Building and Construction Company, of Palmer, Mass.

Combined Phonograph and Photograph.

At a recent meeting of the French Academy M. Lippmann presented a note by M. G. Gueroult, in which it is suggested that by the combined use of a phonograph and an apparatus for instantaneous photography and reproduction of the pictures obtained, it would be possible to reproduce at any future time not only the future speech of a person, but also bring before the audience a vivid picture of the person's gestures and facial expression.

The procedure would be somewhat as follows: A person speaking or singing into the phonograph would be photographed by an automatic apparatus geared with the barrel of the phonograph. The pictures would be instantaneous, and taken at the rate of, say, ten pictures per second. They would then be developed and arranged in a special lantern for reproduction on a screen isochronously with the phonograph, when the latter is reproducing the speech. An audience might thus be enabled not only to hear the utterances of, say, a famous actor, but also see himself and his actions represented on a screen. About a year and a half ago M. A. Bandsept, of Brussels, experimented with a similar apparatus.

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The National Electric Light Association Meeting.

At the recent meeting of the National Electric Light Association, at Niagara Falls, the papers and discussions were confined to topics such as the economical transmission of electrical energy, electric motors, the construction and management of central stations, execution by electricity, and insurance, the same being just now of the liveliest interest throughout the electrical field. The papers on "Electric Railways," by G. W. Mansfield, "The Perfect Arc Central Station," by M. D. Law, and "The Electrical Transmission of Power," by Prof. Roberts, may justly be described as of more than ordinary value to the student as well as to the projector, replete with original experiment and suggestion; clearly stated, too, which cannot always be said of the papers even of painstaking men.

Aside from the scientific interest that always attaches to these gatherings, the feature of this meeting was the discussion of that exciting topic, "electrical executions." Two long and elaborate addresses were made, or rather two and a quarter, for a doctor of medicine, whose views on the subject did not agree with the convention's, was summarily shut off when he had proceeded but a short way in what might be called an argument in rebuttal.

It will be remembered that a law passed the last legislature of this State, without protest from the electrical fraternity, changing the mode of execution of criminals from the halter to electricity, the purpose being to fulfill the intent of the law without the gallows and its debasing accessories. It was not until the time for an execution was near at hand that an objection was raised. Then some one discovered that the use of electricity as a death agent would bring discredit upon the electric current, and since then there has been a strong, though many think an ill-advised, protest against its use.

It was on the afternoon of the second day's sitting that the subject of execution by electricity was brought up by the address of a lawyer invited by the committee to discuss the legality of the objectionable law. The conclusion which his argument was intended to sustain was that the law provided for a "cruel and unusual punishment," the same being unconstitutional. The address contained such obvious fallacies and contradictions that the convention awaited the end with impatience.

Dr. Moses, the second speaker, said that in order to collect information for the convention, a letter was addressed to every manager of a central station in the United States, to the number of 800, for evidence on important points. If electricity was to be used for a killing agent, it should be a certain agent. Instead of being a merciful agent, it is shown to be the most cruel and dreadful agent imaginable. He got several hundred replies, from which he estimated that there had been 73 accidents in central stations, 19 only being due to the alternating current, the balance to the continuous. From the letters received he concludes that no two people reviving from shocks had the same sensation. At the close of his address he read a resolution looking to the repeal of the new law relating to electrical executions.

At this point Dr. Fell, of Buffalo, got the floor. He was the only man at the convention to say a word in favor of the law. He described himself as a physician, not interested in any electric lighting company, his only purpose to serve the cause of humanity. To his mind there was no agent like electricity yet discovered that could execute criminals with such dispatch and with so little pain, and he was satisfied that what had been done with the lower animals could be done with man.

"The question is," said he, "do we want to have the horrors of hanging kept up? I feel that the use of electricity for the execution of criminals is not going to have the effect you think it will have. I may not look at it from the same point of view you do. I wish I could. If I thought its use would retard electrical progress, I would say, do not use it."

By this time the convention got the drift of his remarks, and he was interrupted.

"I would like to ask the gentleman which has killed more people, gas or electricity? Is it not a fact that a week or two ago a new method for the destruction of animals was introduced in the city of New York, and that that was publicly mentioned in the papers as a more humane method of dispatching dogs than the method heretofore prevailing—that is, the introduction of gas in a sealed box, whereby they receive a painless death?"

Dr. Fell—"I can answer that, very readily. Possibly the use of gas or any means of that kind to produce death is painful during the first inhalations—very painful indeed, until a man is asphyxiated—until asphyxiation takes place, and that gas would be more painful than electricity on account of the nerve current being so much less than the current of electricity."

The lawyer who made the first address—"I would like to say two or three words as a man. I had to talk as a lawyer before. I want to say to you gentlemen, members of the National Electric Light Association, that if you have got a particle of spunk in you, it is time to bring it right out; but if you want to go down and have your whole society and profession—I call it a profession—killed financially, then you want to allow this execution to take place. I tell you, you are scaring all the men, women, and children in the United States by allowing this to go on. You are fixing it so that my wife does not dare have it come into the house. I got her about ten or twelve years ago so she would allow a telephone to be put in, but you are fixing it so that I cannot have an electric light. These men who come in for the purpose of striking at one part of your trade—you have got to stop that. It is for you to go before the governor, not with resolutions, but send him car loads of delegates; go yourself; say, 'Here, this strikes our pockets. It is the case of gas against electricity. It is the case of one man with one kind of a current against another man with another kind of a current.' And I say to you right now, be men. Do not fool around with this any longer, but go there by car loads and lie right down on your governor so that he has got to commute that man's sentence."

A member here took exception to a remark of the doctor's to the effect that many had been killed by the electrical current. He showed that such statements were greatly exaggerated, citing cases where such claims, when investigated, proved groundless, a notable one being a claim that hundreds had been killed, the claimant admitting that the only knowledge he had of the fact he got from a newspaper.

The debate was wound up by the appointment of a committee to present the resolutions offered earlier in the proceedings.

"Development and Progress of the Storage Battery," by William Bracken. Mr. Bracken represents a storage motor company. The chief obstacle has been in handling batteries (for motors). This has been overcome. His company, which, he says, is now running 10 motors continuously, is able to remove the exhausted batteries and put in fresh ones in from 2 to 3 minutes. The rack that has been constructed will hold batteries enough for 10 or 20 cars, the space being 6,000 feet or stall room for 150 horses. The cars leave the station with 35 electrical horse power hours stored in each, consuming less than 12 horse power in a run of 12 miles. When the current required exceeds 150 amperes, the battery is automatically cut out. His first standard car, he said, has run in three months over 6,000 miles, carried over 80,000 passengers, and never met with accident. He said the positive plates of the battery have a life of six months. The raw material in two sets of batteries capable of running a car 120 miles a day costs, exclusive of the containing jars, about $300. It will cost $4,000, he said, for horses to run a 16 foot car 120 miles a day and $1,500 to buy enough battery to do that work. The batteries can be maintained for half the cost of horse keep. His cars, he said, take one electrical horse power hour per mile. One of the grades of the road operated is 4½ per cent and 600 feet in length. He estimated the cost of motive power for a car day of 75 miles at $3.40 as against $7.50 for horses, $5 for 75 miles covering the cost in winter. By motive power he referred to the cost of energy at two cents per horse power hour and $700 a year for keep of batteries and motors. Power, he said, had been offered his company at the price named. The storage battery will not do for steep grades, becoming heated under such conditions; the chemical energy, instead of exhibiting itself in the form of electrical energy, exhibits itself in the form of heat, with consequent injury to the battery. It is not economical to ascend grades of more than 6 per cent, and they must be short at that.

ELECTRIC RAILWAYS.

G. W. Mansfield estimated the population of the country six months hence at 66,874,354.

For the transportation of this number of people in the streets of our cities and towns, the most accurate figures it is possible to obtain show the engagement of about 425 companies, employing 28,000 cars, 125,000 horses, and operating some 3,500 miles of track. The capital invested is variously estimated from $175,000,000 to $200,000,000.

As a result of most careful compilations and estimates, it is reasonably sure that at least 1,500,000,000 passengers are transported.

Still more striking is the importance of the street railroad business when compared with the magnitude and extent of the steam railroads of the United States. The figures of 1887 show a tabulation of 147,998·60 miles of railroad and 20,582 passenger cars, and passengers carried but 428,225,513. With nearly an equal number of cars and forty-two times more road, only one-fourth as many passengers were carried. Behold the yet more amazing figures: The horse cars of the city of New York carry 199,491,735 passengers, almost half as many as are carried by all the steam roads in the United States. If to this number are added those carried by the elevated roads, we have the total of 371,021,524, or almost as many passengers are carried in New York City alone as are annually carried by all the steam roads in the whole United States. The street railroads of the State of Massachusetts carry over 44,000,000 more people than all the steam roads in that State. One road alone, the West End, of Boston, carries nearly 10,000,000 more than all the steam roads combined.

He went on to describe experiments made on many of the electrical roads (overhead trolley system) with a view of estimating relative efficiency, the small ones with the large ones, and the latter with horse traction. As to total electrical and commercial efficiency, he did not pretend to be strictly accurate, so many difficulties are in the way.

From estimates based upon many figures he felt certain that a total electrical efficiency of at least 70 per cent can be obtained, and a total commercial efficiency measured from the indicated horse power of the engine to the car wheel horse power (W. H. P.) of from 45 to 50 per cent. If the roadbed, rolling stock, and all the electrical apparatus is maintained as it should be, he saw no reason why this figure could not be exceeded.

Unquestionably, to the railroad man, one of the most vital points is the cost of repairs. We all know that in so far as power is concerned, a horse power can be produced and delivered 10 hours per day the year round with a profit at about $75 per year. The cost of maintaining a horse for only about four hours' work per day on a horse car is not far from $190.

How should electric light companies charge the railway companies for power? It is an exceedingly difficult thing to estimate upon the requisite power, as the conditions are so fluctuating and so variable. After, however, the question of the amount of power has been settled, the next point to determine is whether they shall charge the railway company by the hour, by the day, or by the car mile. We have a large number of roads already hiring power of local companies. All of the methods just mentioned are in use. Upon small roads where the schedule of the railway company is such that they have only a few cars running continuously, meeting emergencies by extras, and where the grades are heavy, a satisfactory basis has been to charge so much per day per car, the price ranging all the way from $3 to $5, $6, and even $7.

When the roads are of moderate size, or are subject to many variations and sudden demands on the part of the public for better facilities, or when the line runs to some resort and the main bulk of business lies in picnics, etc., charges on the hour basis are sometimes preferred. This price varies from 15 to 30 cents per hour. On larger systems, where the schedule is definite and fixed, the mileage basis is preferable by far. The prices on this basis range from two to six cents. It was readily seen that if the cars ran at infrequent intervals, and if the morning and evening traffic was especially heavy and required a larger number of cars, while during the major part of the day only a few cars were out, the mileage basis would be quite unsatisfactory, since on the whole you would have to make steam possible for the maximum railroad output, and maintain it throughout the day. All of these estimates, however, can only be determined by knowing the local conditions and circumstances.

There are some 1,600 central electric light stations already located throughout the country, and some 425 railroad companies that sooner or later will have to have electric power.

He believed the time rapidly coming when great electric stations, from 5,000 to 20,000 horse power, are to be established. There are plants of from 5,000 to 10,000 horse power already built for manufacturing purposes. He has been told that the Calumet and Hecla plant has in the neighborhood of 12,000 horse power. The New York Steam Heating Company has about 10,000 horse power of boiler capacity in its stations at Greenwich Street, New York.

There are many mills equipped with power of from 1,000 to 5,000 horse power. Even our ocean steamships are plants of from 8,000 to 12,000 horse power.* Why cannot electric plants of such power be built? Why are they not? Is there not business enough in lighting, power, and railroading? Almost every station I go into, the country over, is adding to its capacity. "New occasions teach new duties, time makes ancient good uncouth." The horse is uncouth. Electricity is our life.

Other papers were: "Electrical Transmission of Power," Professor E. P. Roberts; "Value of Economic Data to the Electrical Industry," A. R. Foote; "The Perfect Arc Central Station," M. D. Law; "Report on Harmonizing Electrical and Insurance Interests," P. H. Alexander; "Dynamo Room Accessories for Intensity, Potential, and Resistance Measurements."

A NEW idea in Germany is the wholesale manufacture of mortar of the best quality, to be sold to small builders and private individuals. Some 2,000,000 bbl. were thus sold last year in Berlin. This obviates the necessity of making the mortar on the ground under unfavorable circumstances and at unnecessary expense. By this system—carried out with respect to other materials—a builder needs only an office, and can dispense with the cost of maintaining large yards at heavy rental for the storage of materials.

*The steamers City of Paris and City of New York have over 20,000 indicated horse power.—ED.

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Progress of the United States of America.*

BY EDW. MARBEAU.

The American nation is destined to take, sooner than is generally supposed, the first place among the states of the globe. It is only necessary to glance over the statistics to see that the progressive advance of the United States threatens Europe with a competition such that there will forcedly come a moment in which the axis of industrial power, human activity, and political influence will shift to the profit of the new world. What will become of old Europe on the day that China, in her turn, enters into the great movement of industrial expansion? If we abandon Africa to the propaganda of Islam, and if the statesmen of the old continent do not seize the last occasion which offers itself to attach Africa and the black race to the destinies of Europe, it will be all up with the preponderance that it has hitherto held over the destinies of the human race. Mr. Paul Barré sends us the result of some conscientious researches that he has made into the best statistics, and we publish them in the hope that they will facilitate the task of those who are attempting to enlighten public opinion upon the peril that Europe is running, and to draw it into that movement of expansion which is the condition of its safety.

Extent and Population.—The United States of America, which separated from England in 1776, and elected their first president in 1789, now consist of 42 States, 6 Territories, and 1 Federal District. The total area of the Union, including Alaska, is about 3,605,000 square miles. As for the population, that, during the century, has made a truly fabulous progress.

While Great Britain's population has, in fifty years, increased by 10 millions, France's by 5 millions, Germany's by 16 millions, the population of the United States has increased 37 millions. It has been calculated that, since 1790, the population of North America has been doubling about every 26 years. At present, the population of the American Union must certainly exceed 62 million inhabitants. Now, in 1790 the population did not reach 4 millions. In one century, then, the population has varied in the proportion of 1 to 15·5.

If this ascending advance continues, and there is every evidence that it will, the United States in 50 years will count more than 200 million inhabitants, and in 70 years will be as populous as Europe.

Four fifths of the present population consist of Americans of English origin, the other fifth consists chiefly of Germans, more than three millions of whom have arrived within the forty years, only, comprised between 1840 and 1880. Countries other than England and Germany have furnished but little to the emigration, so the French, Italians, Spanish, etc., who have taken up their abode in the United States are swallowed up in the immense mass of the Anglo-Germans. In 1880, the cities contained a quarter of the total population of the United States.

Apropos of immigrants, let us recall the fact that 13,500,000 have arrived in the United States within a century. The annual number of them varies much with the year. Thus, in 1882, 788,000 were received, while in 1886 the number was but 334,000.

Financial Condition.—In 1850, the fortune of the United States was $8,430,000,000, while that of Great Britain was estimated at more than $22,500,000,000. Thirty years have sufficed to change things around.

In 1884, the fortune of Great Britain was estimated at $45,000,000,000, and that of the United States at $55,000,000,000, in which the American manufactures represent a value of nearly $5,600,000,000, say about half that of all the European manufactures combined, that is, $13,000,000,000.

If we admit that the fortune of France is about $40,000,000,000, and that of Germany $25,000,000,000, it will be seen that the United States is at present the richest country in the entire world.

Despite the immense sacrifices made during the war of the rebellion, the United States are in the most prosperous financial situation of any country in the world. While in ten years they have paid off $530,000,000 of their debt, and in another decade will have entirely wiped it out, the different states of Europe still owe $23,400,000,000. The interest on this crushing debt is annually figured at from $800,000,000 to $1,000,000,000, to be raised from the labor of European nations.

In order to render the comparison still more striking, let us take France and England only, whose united population scarcely exceeds a quarter of that of the American Union. France and England annually pay $315,000,000 for the interest of their debt and $340,000,000 for their army and navy. They keep 730,000 available men in service, and, estimating the possible work of each of those at but $100 a year, that represents a further cold loss of $73,000,000; so that it is impossible to estimate the annual charges resulting from the debt and the army and navy at less than $620,000,000.

Well, in spite of an enormous amortizement, the United States depend at present, for these three services, upon $152,500,000. That is to say, that the cost of these three services for France and England alone is figured annually by a difference of $469,000,000 to the advantage of the American system. Counting per head, we find that the French and English systems cost $12.75 per inhabitant, or $63.75 per family of five persons, while the expense in the United States is not $2.50 per head, nor $12.50 per family. Let us add that the United States might much more easily support the overwhelming burden that weighs upon the English and French taxpayers, who are oppressed besides by local charges.

If this state of things does not change before long, it will therefore be necessary to expect a rapid decadence of the European nations in their productive power and their prosperity as compared with those of the United States. Such decadence could be prevented only by finding an immediate means of causing the population and wealth of Europe to increase as rapidly as the population of the United States do. Now, not only does such a means not exist, but the very severity of the conditions that the present military system imposes upon the old world forces innumerable emigrants to leave it, and a large proportion of these adds its labor to the other elements of prosperity of the American republic. Were the people of Europe to deliberately try to ruin themselves to America's profit, they would, therefore, not act otherwise then they are doing.

Army and Navy.—A comparison of the American military budget with that of the great western powers—France, England, and Germany—gives the following results: In France, we find annually inscribed in the army and navy budgets $182,500,000, or $4.98 per head of inhabitants; in England, $158,400,000, or $4.20 per head; and in Germany (1886), $113,000,000, or $2.44 per head. The United States keep up an army of but 27,000 men and expend on this account only $50,000,000 per year, or scarcely 86 cents per head.

Opposite these 27,000 men let us put the 1,224,604 soldiers kept in service in time of peace by the three above named powers, and we shall find that in this item they yearly consume one-eighth of their productive power. Again, this estimate is below the truth, if we consider that the men thus taken from the pursuits of peace are all in the maximum of their strength and at the age when character is formed. The loss of revenue that results from such a state of things becomes appalling when we consider it as a factor of the industrial contest with the United States.

The United States, then, have an insignificant standing army and an insignificant navy; but, a quarter of a century ago, at the time of the war of the rebellion, they put into the field, at the first call, two million well armed men and 626 war vessels.

Commerce.—The imports and exports of America nearly equal those of France and Germany, say about $1,500,000,000, but they are far from coming up to those of England—$3,000,000,000. As for the interior commerce of America, that of no other nation offers any comparison with it. The annual railway freight receipts in the United States exceed $550,000,000—a sum greater than that paid by England, France, and Italy, combined, for the same object. The Pennsylvania system alone carries a larger tonnage than that of all the merchant vessels of England.

Merchant Marine.—The merchant marine of the republic comes immediately after that of England, In 1880, the total tonnage of the English merchant marine was 18,000,000 tons, and that of the United States 9,000,000—a tonnage four times as large as that of France. American ships monopolize nearly 20 per cent of the total receipts of the commercial maritime carriage of the world. France and Germany figure in this commercial contest only for 5 per cent each.

Ways of Communication.—The United States possess 145,200 miles of railway (end of 1887), while Europe has but 124,200. As the entire world contains about 337,000 miles, it follows that the United States have 44 per cent of the railways of the globe. They will soon have more than the rest of the world!

Moreover, nowhere can a person travel so comfortably and luxuriously, owing especially to the American invention of sleeping cars, which permit of making trips of seven days and seven nights, without fatigue, from one ocean to the other.

Besides its railways, America has rivers that are the largest in the world. The Mississippi is equal to all the rivers of Europe combined, with the exception of the Volga. Its length is about 3,200 miles, and that of its navigable affluents is more than 19,200. The Hudson is navigable for large steamboats as far as to Albany, that is to say, to 160 miles from its mouth.

There are a dozen other rivers of like importance. There are a number of large seaports at considerable distances from the coast properly so called. There is nothing more curious than to see ships of 3,000 tons at a distance of 1,500 miles from the sea. These great natural watercourses are, in addition, completed artificially and connected with each other by canals. In 1880 there were in the United States 4,300 miles of canals that cost $265,000,000. The maritime coasts accessible to navigation have an extent of 13,000 miles, and if we count the islands and bays we find that the American seashore has a total length of 32,000 miles. Moreover, the length of the coast and of the lakes accessible to navigation is 1,600 miles.

Production.—To show the astonishing progress of American production in a very short lapse of time, we give the following comparison of results collected twenty years apart.

	1866.	1886.
Gold and Silver	$63,500,000	$83,500,000
Sugar	20,000,000 lb.	286,000,000 lb.
Cotton	1,000,000,000 "	3,182,000,000 "
Wheat	212,000,000 bu.	357,000,000 bu.
Corn	786,000,000 "	1,936,000,000 "
Petroleum	132,000,000 gal.	943,000,000 gal.

Post Office and Telegraphs.—In no country in the world, in a relatively short space of time, has the postal service been so extensively developed. There are at present in the great American republic 57,376 post offices (against 23,328 in 1866), while Germany has but 18,583, Great Britain 17,587, and France 7,296. The postal routes of the United States extend over 240,000 miles, those of Germany 51,000, those of France 40,000, and those of England 25,000.

The American post office sent last year more than 3,576,000,000 letters and printed documents of all kinds, while the English did not exceed 2,270,000,000, the Germans 1,816,000,000, and the French 1,400,000,000.

The proportion of postal matter forwarded is 71 per inhabitant in the United States, 61 in England, 41 in Germany, and 37 in France.

Finally, the first of these nations spent for its postal operations 56 million dollars, the second nearly 44 million, the third nearly 29 million, and the fourth nearly 29 million.

As for the American telegraph system, that is the most extensive in the world. At the close of 1884, it comprised 138,600 miles of lines and 417,600 miles of wires. At the same epoch, Russia had 60,600 miles of lines and 138,000 miles of wires, France (with colonies) 51,000 miles of lines and 150,000 miles of wires, and Germany 46,400 miles of lines and 159,000 miles of wires.

Such prosperity, as astonishing as it may seem at first sight, and although it has never had a precedent in history, is quite easily explained.

When we study a map of the United States and see this country, with soil so rich and fertile, watered by immense rivers, and containing (aside from the Allegheny and Rocky Mountains) but very few mountains, we see very clearly that it had to be called upon some day or other—seeing the great facilities of communication—to receive a very dense population.

Not having, in any way, had to take the past into consideration, the American colonists, recruited from among the most enterprising and courageous Europeans, have not, like European nations, had race struggles to encounter in order to establish themselves in other new territories. They have had the fortune not to meet with dangerous neighbors ready to disturb their life of activity and labor. War is almost unknown among them. So the future has responded to their first expectations, and every one is obliged to recognize to-day that it is necessary to count with the United States, not for a struggle with arms, but for a graver one—the commercial and maritime struggle, the struggle of labor.

* From *Revue Francaise de l'Etranger et des Colonies, et Gazette Geographique.*

Why It Is.

The statement that out of every hundred men engaging in business, but three are successful, is a statistical chestnut which may be correct in the main, and if so, the pertinent inquiry, What is the matter with the other ninety-seven? is in order. This query, so far as it relates to manufactures using steam power, has a partial answer. A leading firm has recently been pursuing a systematic series of investigations to determine what percentage of the power actually developed was utilized in production and how much was wasted. Careful tests in some of the most prominent manufacturing concerns in the country gave some curious results. In nearly every case it was found that at least fifty per cent of the power was wasted. One large establishment wasted sixty-five per cent and another seventy-three per cent, while in another, where the engine was developing sixty indicated horse power, eleven-twelfths of this amount was wasted in friction and other useless work, and only five horse power was available for purposes of manufacture. In most manufacturing enterprises the cost of fuel is a very serious item, and *The Stationary Engineer* thinks it would appear to be well worth the time of the owners to start a little investigation as to what becomes of the power they pay for. Economical production and judicious utilization of steam are the beginning and end of steam using, and the concern which pays no attention to these points need scarcely hope to be one of the lucky three.

Typhoid.

Dr. Edson sums up the etiology of typhoid fever in the following words: First, typhoid fever never infects the atmosphere; second, it never arises *de novo;* and third, the causes of the disease, in order of their frequency, are as follows: First, infected water; second, infected milk; third, infected ice; fourth, digital infections; fifth, infected meat.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Jonas P. McDowell, Foote, Iowa. The drawhead has pivotally mounted jaws from which a lever-carrying shaft extends upward, rods being connected to the lever and by links to the jaws, in connection with which springs are arranged, the device being designed to couple cars automatically, and so they may be uncoupled without the operator going between them.

CAR BRAKE AND STARTER.—Amos M. Vereker and Stephen M. Yeates, Dublin, Ireland. This invention covers an improvement on a former patented invention of the same inventors, there being combined with the car platform and truck axles ratchet clutch sections, chains, levers, springs, etc., in such manner that the force applied for braking is utilized for starting the car.

RAILWAY SWITCH.—Walter N. Knight, Boardman, Fla. In this switch the inner rail of the side track has a pivoted section at its inner end, and this section rises or inclines gradually upward to lap up on the outer rail of the main line when the switch is open to the siding, or be adjusted laterally clear of such rail when the switch is closed to the siding, the switch dispensing with the use of frogs.

Mechanical.

BELT GEARING. — John A. Lough, Chetopa, Kansas. This invention covers a means of driving two pulleys that are near together, by running a single belt around the two pulleys and then running the driver on this belt instead of on the pulleys themselves, thus doing away with the use of a tightener, and more readily transmitting the power of the driving belt.

MACHINE FOR FORMING BEAM STRAPS.—Henry McDougall and Roger Potter, New York City. Combined with a base plate formed with a longitudinal and transverse groove is a forming block, a clamping screw passing through another block and engaging a nut in a recess, with other novel features, the invention being an improvement on a machine formerly patented by the same inventors, whereby the implement is made adjustable.

NUT LOCK.—Andrew Reed, Lawrence, Kansas. This is a lock in which the threaded end of the bolt has reduced and flattened sides, and the nut is held against turning by a separate locking plate which embraces the flattened end of the bolt and extends down beside one of the faces of the nut, the squared end of the bolt keeping a wrench-shaped locking bar from turning, and the latter preventing the nut from rotating.

WRENCH.—Charles A. Swanson, Marshall, Minn. This is a self-adjusting wrench having a pivoted handle and attached circular rack, with stationary jaw connected with the handle by its pivot, and having other novel features, forming a tool which can be used either as a pipe wrench or a monkey wrench.

Agricultural.

PLOW SHOVEL.—William L. Sexton, Scranton City, Iowa. This is a transversely divided shovel having a hinge connection of the divided portions, which are held in proper relation by a break pin attachment, so that in case of the point of the shovel striking an obstruction the lower portion will be released by the breaking of the break pin, and will drop or swing back, preventing the breaking of the shovel.

CORN CUTTER. — Benjamin F. Moore, Ivanhoe, Kansas. This invention consists of a wheeled platform provided with fixed knives, and carrying means for setting up the shock in the field, being simple and durable in construction and specially designed to cut corn in the field, gather it, and set it up in shocks.

Miscellaneous.

WINDMILL.—John W. Currie, Solomon City, Kan. This invention is designed to comparatively free the piston rod from friction, to use a larger wheel shaft than ordinary, and provide wooden boxes for the shaft, which may be expeditiously and conveniently detached and replaced when found desirable, the several parts being so united that if one part should break, that part only need be replaced.

CHARCOAL APPARATUS. — Jacob Scherffius, Winona, Minn. The fire chamber and the charring chamber are each formed by a jacketed inclosing case forming surrounding chambers, in communication with each other through a dampered connecting pipe, whereby an excess of heat is developed which may be utilized for the production of power by conducting off the heated and combustible gases.

OIL CAN NOZZLE. — Charles B. Underhill, Lancaster, N. Y. The centrally apertured cap of the can has an air vent from which a reservoir extends downward, with a valved aperture in its lower end, and a spring-actuated valve controls the vent aperture in the cap, whereby oil may be forced from the can when the latter is in any position, and the nozzle will be comparatively free at all times.

BUTTON STRIP.—Edward K. Warren and Joseph H. Ames, Three Oaks, Mich. This is a continuous strip, preferably of feather bone, forming a stay or stiffener and admitting of being stitched through and through, there being combined with it buttons arranged at suitable distances and separately attached to the strip by tapes or other flexible connections, for use with waists, corsets, and other garments.

METAL CLAD SHOE SOLE. — John G. Dickson, Beaver Falls, Pa. This invention provides a flexible metallic bottom for boots or shoes especially designed for foundrymen, furnacemen, quarrymen, etc., the bottoms being protected by sectional metallic plates studded on their outer face, and having their adjacent edges provided with interlocking recesses and projections, giving an articulated construction to the entire plate, to permit of the natural bending of the foot in walking.

TURFING IMPLEMENT. — Melville C. Ayer, Brooklyn, N. Y. This is an embroidering device provided with the usual needle block and looper block mounted to slide one on the other, being specially intended for turfing or rug machines, and sewing, for automatically feeding the machine forward, while simple and durable in construction and very effective in operation.

PHOTOGRAPHIC CAMERA. — George Shorkley, New York City. This invention consists of a swing-back and a universal joint connecting the swing-back with the camera casing, being especially adapted for detective cameras, to hold the plate holder always in a vertical position irrespective of the position of the camera casing, so that the objects photographed will appear in a natural position on the dry plate.

PAINT COMPOUND. — Nineveh R. Bonner and Ira L. Burlingame, Pana, Ill. This is a paint more particularly designed for use upon roofs, whether of tin, iron, wood, or other material, to be put on hot, and to make the roof fireproof as well as waterproof, consisting of mortar cement, yellow ocher, Venetian red, resin, sulphur, alum, asbestos, liquid japan, coal tar, and other ingredients.

FLOWER BOX. — Annie Cleland, New Orleans, La. By this invention a strong metal box, preferably crescent-shaped, is to be fitted against the outside of the window sill, and supported by two strong iron bars, while within the box is a perforated false bottom, supported above the solid bottom, the earth and flowers resting on the false bottom, and the water dripping therefrom being drawn off through a spout into a cup removably suspended in convenient position.

HALTER.—James H. Philpott, Rising City, Neb. This halter has a runner consisting of a metal casting having upwardly curved ends with an aperture in each end, a pin or stud projecting upward from the casting between the apertures, with other features, whereby the halter may be made partly of rope and partly of leather, and the rope expeditiously adjusted to form a halter capable of snugly fitting the head of any animal.

CONNECTING BAR FOR RIDING SADDLES.—William W. Lewis, Cheyenne, Wyoming Ter. This is a "chincha" or girth-rig connecting bar made of malleable cast iron or other suitable metal, having not only a ring at each end, but also a center ring or loop, whereby the saddle to which the bar is applied may be used either for a double or a single rig.

SERVICE, CASH, AND PASS CHECK.—George D. Smith, New York City. This check has marginal rows of cash value numerals increasing in value from end to end, with a passport character, a serial number, and a printed description of the use of the check, whereby the check entitles the holder to be served, to register the value of single or cumulative orders, to act as a voucher to the cashier, etc.

TICKET CASING FOR CAR SEATS.—Rensselaer J. Smith, Albany, N. Y. Combined with a reversible car seat are oppositely arranged fare boxes secured to the back at its upper and lower edges, whereby one fare box will always be in position to receive the fare, and the box serving to receive, exhibit and store the ticket of the passenger, and prevent fraud by either conductors or passengers.

LAMP ATTACHMENT. — Catharine S. Walker, Galveston, Texas. This is a device adapted to be secured to the surface of a sewing machine table in such manner that the lamp will be held to cast its light upon the presser foot and needle from the back, and will not obstruct the table or interfere with the work, and when not in use may be swung underneath the table out of the way.

GAS LIGHTER. — Sumter B. Battey, New York City. This is a device for automatically lighting gas jets by means of percussion pellets, the latter being held in a tube to be fed, one at a time, to a cylinder which has an opening opposite the tip of the burner, the pellets being forced out and ignited by a piston operated as the gas key is turned.

BRACKET FOR ELECTRIC LAMPS. — John S. Merrill, Columbus, Ohio. This is a swinging bracket for holding electric lamps in the position of use, a flange attached to the wall holding a screw-threaded rod, to the outer end of which is jointed a rod, another rod being jointed to the extremity of the latter, and carrying on its outer end a hook for receiving an eye attached to the lamp, the eye being held in the hook by a spiral spring.

BUREAU.—Orrin D. Miles and Edward F. Scollay, Templeton, Mass. This invention provides an article of furniture which can be readily taken apart and compactly folded for transportation, the framed panel ends of the casing being connected to the back by hinges, and the front posts connected at the bottom by a base board detachably secured to the posts by angle plates and screws, etc.

SWING GATES.—William C. Hooker, Abingdon, Ill. This is a device for opening and closing gates in which a rock shaft is supported by posts at the rear of the gate and hinged centrally on the under side to the posts, an arm on the rock shaft having a link connection with the gate, whereby the shaft, as thrown past the center, will assist in the movement of the gate, the device being readily manipulated from either side of the gate.

MERRY-GO-ROUND.—David G. Johnson, Trenton, N. J. This apparatus has two rotary overhead wheels, with pull ropes hung therefrom, an endless cable running on the wheels, and pull ropes or devices hung from the cable, with other novel features, for use at seaside or summer resorts, or in roller skating, for persons to pull or draw themselves in circles over a floor or platform.

AUTOMATIC POOL REGISTER.—Thomas C. Devlin, Pueblo, Col. This invention consists of an electrical register to be placed against the wall in view of the players, and connected with a battery circuit extending to the pool table, with a circuit breaker in a trough leading from the pockets, so that each ball pocketed will alternately close and open the circuit and effect its own count on the register.

LETTER BOX. — David Rosenthal, Hudson, N. Y. This is a box having an upper and lower compartment, one adapted to receive letters and the other to receive papers, etc., hinged doors closing the openings, and rods being pivoted together and to the doors, whereby both doors will be simultaneously opened or closed.

MAIL BAG FASTENING. — James A. Roosevelt, Hempstead, Texas. This fastening consists of a slide formed with keyhole slots and carried by an overlapping flap, the slide being adapted to engage headed studs secured to one side of the main portion of the pouch and passed through apertures in the other side of the pouch, the device being quickly and easily manipulated to fasten or unfasten the bag.

MAILING DEVICE FOR NEWSPAPERS, ETC.—Lucien P. Bardwell, Pratt, Kansas. This is a tool to be operated either by hand or power for affixing the name or address or other slips to the papers to be mailed, or for putting postage stamps on letters, etc., the invention covering various novel features, and being adapted for different purposes or uses.

ATTACHMENT FOR SCALES.— Lucius L. Wands, West Shokan, N. Y. This is a price-indicating attachment for weighing scales, whereby the value of any fraction of a given unit of weight at any price per unit will be indicated, revoluble cone-shaped indicators being combined with a counterbalancing weight and connections, so the indicator will be turned as the weight is moved.

SASH FASTENER. — Harrison Staggs, Valencia, Kansas. This is a device designed to serve as a substitute for the weight and pulley ordinarily employed, and by which also the upper and lower sashes may be raised or lowered any desired distance and locked in place, the device being simple in construction and readily attached.

HAND PROPELLER FOR BOATS. — James S. Lamar, Valdosta, Ga. By this invention a vertically disposed frame is secured to the boat, with longitudinal extending horizontal arms to the outer ends of which swinging bars are pivoted, paddles being secured to the lower ends of the bars, whereby the work of propulsion is designed to be lessened and simplified, so that the most inexperienced can propel a boat.

OIL CAN.—Albert A. Arnold and Newton B. Jamison, Jacksonville, Fla. This is a can having an apertured concaved top from which a fixed spout projects, and a funnel-like auxiliary spout hinged to the can adjacent to the fixed spout, to be swung over the latter and form a shield for it, or to be swung away and form a funnel.

BATH TUB.—Hugo F. Begiebing, New York City. This invention provides for a bath tub underneath the ordinary stationary tubs and sink of a kitchen or living room, and provides novel features of construction whereby it may be swung outward for use and returned again beneath the stationary tubs.

SCISSORS ATTACHMENT. — James H. Norrell, Augusta, Ga. This attachment consists of a bow whose arms extend along the scissor blades, by which the scissors may be used to grip and hold flowers, etc., cut by the blades, retaining such objects until the scissors are opened.

TEMPORARY BINDER. — George A. Blackburn and Daniel J. Brimm, Columbia, S. C. This invention consists of a book provided with an extensible back, binding strips, and a means for tightening the binding strips and the back, the parts being so formed and connected that the book may be expanded or contracted to receive a greater or less number of sheets.

ROAD GRADER.—Merritt H. Walworth, Hillsdale, Mich. This machine has a bifurcated drawbar as a support for the scrapers, one or more supporting beams being attached to the members of the drawbar, with other novel features, the scrapers being so supported as to be capable of vertical and lateral adjustment to throw the earth either to the right or left.

IMPLEMENT FOR DEHORNING CATTLE.—John Z. Benson and Albert Blanchard, Lawn Hill, Iowa. This is a simple and durable device of novel construction capable of cutting the entire circumference of the horn, thus sustaining the strength of the horn until completely severed and preventing one side from splitting down in the head.

ANIMAL SHEARS. — Robert Dixon, Sydney, New South Wales. This invention covers an improvement in sheep shears, there being combined with a casing provided with a comb, a revolving cutter, a flexible arm secured to and projecting from the casing, an endless belt traveling around the flexible arm and passing around the pulley, and intermediate mechanism between the pulley and cutter.

VEHICLE WHEEL. — James W. Brook, Lynchburg, Va. This is a metallic wheel formed of sections, each section consisting of a hub portion and spokes cast integral with the hub portion, a metal felly section being secured upon the ends of the spokes, forming an easily constructed wheel of great strength and durability.

CONVERTIBLE SEAT FOR VEHICLES.—William T. and William Angus, Sydney, New South Wales. This invention provides means for altering the position of the front seat and accessory parts of a phaeton to make it resemble a victoria, and also to make a victoria resemble a phaeton, the seat being supported upon knuckle joints which can be operated without adding or removing any of the parts.

FIRE EXTINGUISHERS. — Andrew J. Goostree, Foxville, Ill. This invention is for controlling and preventing fires by excluding draughts within a building or vessel, the openings being made with outward-swinging closures, a spring being connected to the structure at the hinged edge of each closure, in combination with wires and guide pulleys, whereby the openings may be closed to cut off air currents or draughts from the flames.

DEVICE FOR LOCKING DRAWERS. — Jared H. Rodeheaver, Terra Alta, West Va. This is a device concealed within the desk for locking a series of drawers, the invention providing for a direct application of locking bolts without the use of any springs, the drawers being formed with locking recesses in combination with locking rods having projections, and other novel features.

DOUGH MACHINE.—George H. Cross, St. Johnsbury, Vt. This is an improved duster, to supersede the throwing of flour, starch, etc., taken from the dough board, by hand, the invention consisting of a box with a sieve bottom suspended above the dough board, there being a sliding frame on the bottom held down by cleats while the box is reciprocated.

SHIRT. — Eli Oppenheim, Baltimore, Md. This is an improved article of manufacture, the garment having openings of greater length than width extending from opposite sides of the neck opening into the sleeves, and similarly shaped gussets or pieces stitched to the edges of the openings, the invention applying more particularly to coarse cotton or woolen shirts.

COVERING FOR COTTON BALES. — Robert M. Walsh, New Orleans, La. This covering consists of metallic sheets having marginal wooden strips attached thereto on the inside of the sheets so as to lie against the cotton, forming an envelope to protect the bale from fire and bad weather, to keep it clean, and prevent the pilfering of cotton.

SCIENTIFIC AMERICAN BUILDING EDITION.

SEPTEMBER NUMBER.—(No. 47.)

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References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
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Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1278) T. K. W. and others ask the best method for bluing and browning rifle or gun barrels. A. The bluing of gun barrels is effected by heating evenly in a muffle until the desired blue color is raised, the barrel being first made clean and bright with emery cloth, leaving no marks of grease or dirt upon the metal when the bluing takes place, and then allow to cool in the air. It requires considerable experience to obtain an even, clear blue. The following recipe for browning is from the U. S. Ordnance Manual: Spirits of wine 1½ oz., tincture of iron 1⅛ oz., corrosive sublimate 1½ oz., sweet spirits of niter 1½ oz., blue vitriol 1 oz., nitric acid ¾ oz. Mix and dissolve in one quart of warm water and keep in a glass jar. Clean the barrel well with caustic soda water to remove grease or oil. Then clean the surface of all stains and marks by emery paper or cloth, so as to produce an even bright surface for the acid to act upon, and one without finger marks. Stop the bore and vent with wooden plugs. Then apply the mixture to every part with a sponge or rag, and expose to the air for twenty-four hours, when the loose rust should be rubbed off with a steel scratch brush. Use the mixture and the scratch brush twice, and more if necessary, and finally wash in boiling water, dry quickly, and wipe with linseed oil or varnish with shellac.

(1279) G. D. W. asks: 1. What is approximately the internal resistance of a bichromate of potash cell having two zinc plates and three carbon plates each 3 in. by 3½ in., space between them being ½ in.? A. The resistance of such a cell varies greatly as the solution changes. It would be safe to call it as an average ½ ohm. 2. With is the E. M. F. of such a cell? A. 1·75 to 1·90 volts. 3. With a given field magnet or armature, which will give the greater amount of magnetism—winding with heavy wire of very little resistance and few turns, with a current from a battery with many amperes having a low internal resistance, or winding with finer wire, greater number of turns, much greater resistance consequently, the current coming from a battery of high internal resistance (to suit external), consequently of much fewer amperes, the question being asked with reference to economy? A. This has to be determined by Ohm's law, the requisite data being given. By dividing the electromotive force of the battery by the resistance of battery plus magnet, the amperes of current will be determined. The turns of wire on the magnet have next to be counted, which are to be multiplied by the amperes. The magnet having the greatest number of "ampere turns" will have the greatest power. For economy of working, the lower the resistance of the battery compared with the resistance of the magnet, the better. For economy of installment, the minimum battery will be obtained by making internal and external resistance equal. 4. With a current of 4 amperes, 16 volts E. M. F., internal resistance 4 ohms, which is the better way to connect together in same circuit six electromagnets, each of 5 ohms resistance, in series or abreast, and what will be the total resistance in the latter way? A. To obtain maximum of economy and effect combined from battery named, arrange the magnets two in series and three in parallel, giving a resistance of 3⅓ ohms. If the magnets were arranged in a series of six, they would receive a current of $\frac{16}{34}$ amperes; if abreast or in parallel, they would receive a current of $\frac{16}{4{\cdot}833}$ or a little over 3 amperes. The latter is therefore the best arrangement for effect alone, but it is very uneconomical, as the battery would absorb nearly four-fifths of the electrical energy.

(1280) E. L. B. asks for a process for bluing steel by immersion in acids, or the best method for bluing quick. A. We know of no good method of making a permanent blue in this way, although the following is a recipe which is found to answer sufficiently well for some articles: Dissolve 4½ oz. hyposulphite of soda in a quart of water, and 1 1-6 oz. acetate of lead in another quart of water. Mix and boil the two solutions, and immerse the metal therein a short time, when it will take a blue color, somewhat such as is obtained by heating it. See query 1278 and SCIENTIFIC AMERICAN, November 19, 1887.

(1281) J. G. F.—A drive well will no doubt furnish you with good water. The perforated end of the pipe should be covered by fine brass wire cloth to keep out the sand. Better purchase a point properly prepared and use galvanized iron pipe for driving. Dig a hole 4 or 5 feet deep and box or crib it. Drive the pipe well down into the water stratum and set a sub bucket pump (one with the valve and bucket 4 feet below the surface) upon a platform over the crib. You can buy the whole rig in the pump trade. Be very careful to secure tight joints in the pipe. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 107, for illustrated description of method of driving wells.

(1282) W. A. T.—"Jimsen weed" and "ginsing" are the popular names of two very distinct plants. The first of the two is a corruption of the name "Jamestown weed," the plant that bears it (*Datura Stramonium*) having been so called by the early colonists because it was first observed growing in the vicinity of Jamestown, Va., where it had probably been introduced in ship's ballast from tropical America. The root sent is that of this plant (*Datura*).

(1283) J. B. T., query 1186, asks how to rid a cellar of fleas. L. O. Howard recommends benzine. A safer method is to sprinkle the floor thickly with quicklime, or a good size bundle of fresh pennyroyal scattered over the floor will drive them out. If fresh pennyroyal is not obtainable get 2 ounces of oil of pennyroyal, 2 ounces oil of sassafras, 4 ounces alcohol, shake together well in a bottle and spray around with an atomizer. Substitute sweet oil for alcohol and the mixture rubbed on the hands and face will keep off mosquitoes.—P. H. L.

(1284) C. F. P. asks: Will it injure or benefit cistern water to put into the cistern stone coal? If a benefit, what is the best kind of coal for the purpose? A. Soft coals will injure the flavor of the water, and anthracite is of no value. Charcoal is only suitable for deodorizing water. A bushel of pulverized charcoal on the surface of the water will do much toward purifying the water. It is better to clean the cistern as often as possible and aerate the water by forcing fresh air under the surface with a bellows or blower.

(1285) R. D. B. asks: What is the significance of the term "fever heat" marked upon many thermometers at 112° Fah.? A. Any such marking is misleading. Natural blood heat should be marked at 98, and the maximum is about 99, but any temperature above 105 denotes a fever of great gravity.

(1286) T. E. C.—Clock spring steel is of low grade and not suitable for permanent magnetization. Use thin tool steel hammered to the required size, finished and hardened, then drawn to a brown color or light blue if tempered dry.

(1287) G. A. B. asks what preparation is most durable and cheap to apply on polished steel, to prevent rusting, when exposed? A. Articles that are to be handled may be varnished with mastic, shellac or boiled linseed oil and thoroughly dried in an oven. For articles only to show in store dipping in hot lime water and drying hot will prevent rusting.

(1288) H. L. S. asks: 1. Is the profession of civil engineering overcrowded? A. There is always room for good men. 2. Do you consider it necessary or best for a young man to take a regular college course of four years, or is it better for him to take a shorter course and thus get into actual work sooner? A. A full college course is strongly to be recommended. 3. After he has taken such a course, either a long or short one, can he obtain a paying position without the aid of influential friends? A. It is hard to obtain such a position even with influence. The upward road is often a long one.

(1289) J. D. L. asks: 1. What is the best way to polish German silver, and to preserve mathematical instruments from rusting, said to be caused by climatic influence? A. Polish German silver with rotten stone and oil. To prevent rusting keep in tightly closed box, and if for a long period wrap in waxed paper. 2. The best way to mix colors for stage scenery, the materials and the kind of stuff to work on? Or is there any book published on this kind of work? A. We can supply you with Amateur Work, volume 5, which contains much information on the subject of scene painting.

(1290) W. S. writes: Can you give me the formula for making the explosive on the tip of the ordinary parlor match, also some idea how it is prepared and put on? A. In answer to query 1234 you will find formula for safety matches. For parlor matches dry the splints and immerse the ends in melted stearine. Then dip in following mixture and dry:

Phosphorus (red)	3 parts.
Gum arabic or tragacanth	0·5 "
Water	3 "
Sand (finely ground)	2 "
Binoxide of lead	2 "

Perfume by dipping in a solution of benzoic acid. For precautions, etc., see query 1234.

(1291) W. G. C. writes: 1. Can you recommend a book on incandescent wiring with particular reference to electroliers, and combination gas and electric light fixtures? A. We can supply you with the Incandescent Electric Wiring Hand Book, $1. 2. What treatment would you recommend for a hard wood floor which was given two coats of spar varnish when new, but has since worn off in places? A. Revarnishing is the best treatment for the floor. Possibly it would be well to oil the spots with raw linseed oil before applying the varnish.

(1292) M. J. asks: What mixture or composition is put into rubber in order to harden it after it has been softened by heat. A. Old rubber can be used by mixing with new. No substance is known that will harden it as you describe. We refer you to our SUPPLEMENT, Nos. 249, 251, 252, for a full treatise on the manufacture of India rubber.

(1293) J. H. B. asks how to remove grass stains from white dresses. A. It is among the more difficult stains to remove. A mixture of pulverized starch and alcohol placed on the stain and allowed to dry upon it, moistening and burning sulphur under it, and the application of a bleaching agent such as Javelle water, followed by thorough washing, are to be recommended.

(1294) W. T. B. asks for a receipt for making transparent paint for stereopticon slides. A. In our SUPPLEMENT, No. 423, you will find the subject treated. Oil colors are excellent. The choice is restricted to transparent colors, such as carmine, Prussian blue, gamboge, etc.

(1295) C. J. L. writes: What is the recipe for making the fine slating now used in renewing the surface of blackboards? A. Various formulæ are given, of which the following is typical: 1 gallon 95 per cent alcohol, 1 pound shellac, 8 ounces best ivory black, 5 ounces finest flour emery, 4 ounces ultramarine blue.

(1296) J. L. T. writes: I send you (inclosed) a specimen of a sediment, large quantities of which are deposited from a spring of clear water that lies at the foot of a mountain on Oak Creek. This deposit is called vegetable iron here. What is it? A. It it is a mixture of hydrated oxide and carbonate of iron. It may be formed by the action of the humus or other organic acids upon the iron of the soil. The iron dissolved by them decomposes or is precipitated as carbonate, which gradually oxidizes, forming hydrated oxide or limonite. This is the process of formation of bog iron ore. It may, however, be in solution in the water in other forms, and then be deposited by the action of the air.

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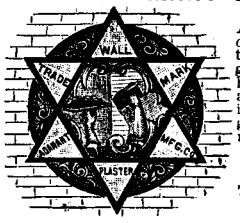

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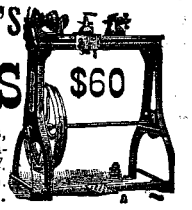

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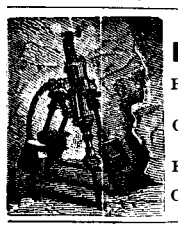

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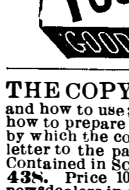

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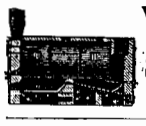

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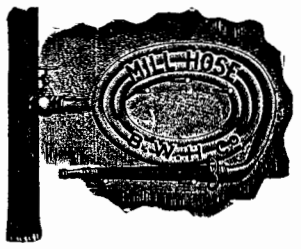

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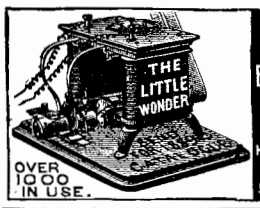

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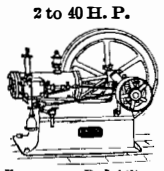

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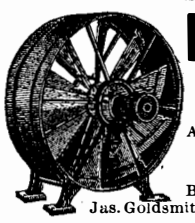

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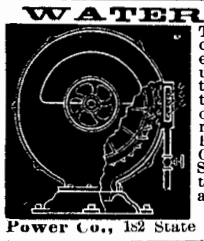

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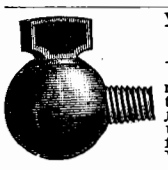

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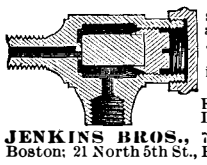

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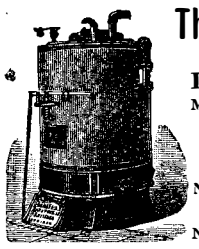

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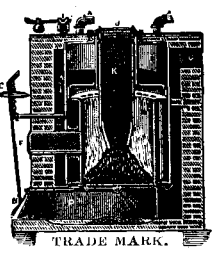

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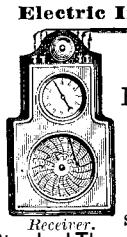

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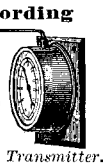

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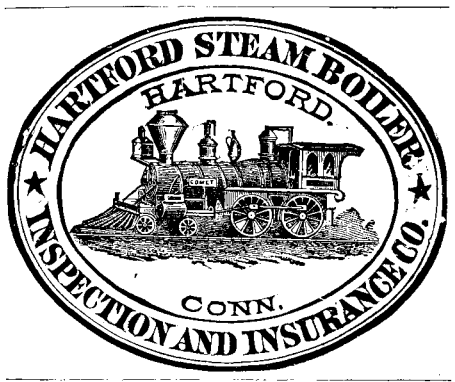

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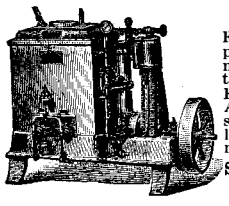

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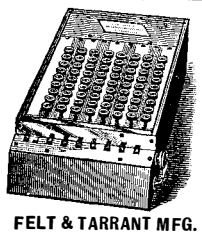

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